HEWLETT-PACKARD

HP-67/HP-97

Business Decisions Pac

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Introduction

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

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

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

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

We hope that the Business Decisions Pac will be of assistance in the solution of your problems. We would very much appreciate knowing your reactions to the programs in the pac, and to this end we have provided a questionnaire inside the front cover of this manual. Would you please take a few minutes to give us your comments on these programs? It is in the comments we receive from you that we learn how best to increase the usefulness of programs like these.

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

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Appendices

A WORD ABOUT PROGRAM USAGE

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

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

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

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

The HP-97 users may also want to keep a permanent record of the values input to a certain program. A convenient way to do this is to set the Print Mode switch to NORMAL before running the program. In this mode, all input values and their corresponding user-definable keys will be listed on the printer, thus providing a record of the entire operation of the program.

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

INTERNAL RATE OF RETURN

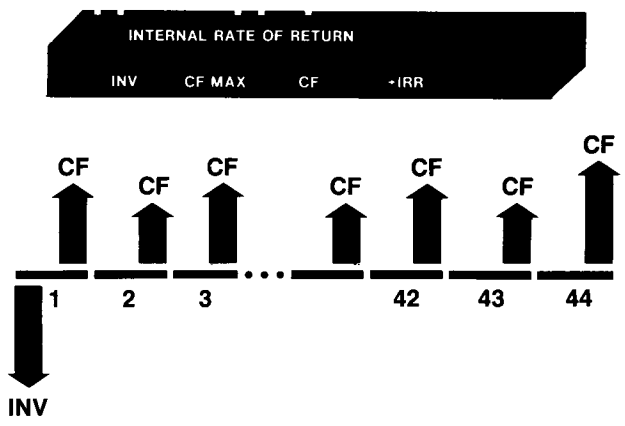


Figure 1

Note:

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

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

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

Zero should be entered for periods with no cash flow.

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

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

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

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

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

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

Note:

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

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

Example 1:

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

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

Keystokes: **Outputs:**

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

Example 2:

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

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

Keystrokes: **Outputs:**

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

INTERNAL RATE OF RETURN—GROUPS OF CASH FLOWS

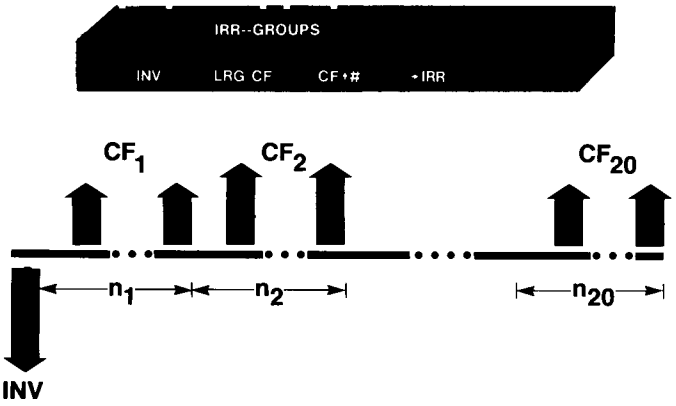


Figure 2

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

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

Zero should be entered for periods with no cash flow.

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

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

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

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

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

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

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

Note:

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

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

Example 1:

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

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

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

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

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

Example 2:

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

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

What is the expected rate of return?

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

DISCOUNTED CASH FLOW ANALYSIS
NET PRESENT VALUE

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

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

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

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

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

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

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

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

Example 1:

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

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

Keystrokes:		Outputs:
70000 A 13.75 B		
14000 D	→	−57692.31 (NPV after 1 cash flow)
11000 D	→	−49190.92 (NPV after 2 cash flows)
3 C 10000 D	→	−31172.57 (NPV after 5 cash flows)
9100 D	→	−26971.76 (NPV after 6 cash flows)
2 C 9000 D	→	−20108.39 (NPV after 8 cash flows)

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

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

Example 2:

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

PURCHASE

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

LEASE

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

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

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

LEASE

0 [A] 5 [C] 1310 [D] ⟶ 4391.32

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

DIRECT REDUCTION LOANS
SINKING FUND

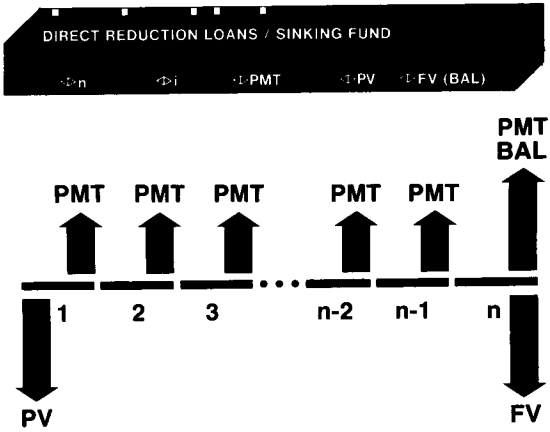


Figure 3

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

The following variables may be inputs or outputs:

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

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

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

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

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

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

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

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

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

Example 1:

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

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

Example 2:

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

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

Example 3:

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

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

Example 4:

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

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

Now determine the purchase price of the note.

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

Example 5:

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

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

Now calculate the mortgage amount less fees.

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

To obtain the annual percentage rate, press:

B 12 × →	8.97	(% APR)

Example 6:

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

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

Example 7:

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

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

ACCUMULATED INTEREST/REMAINING BALANCE

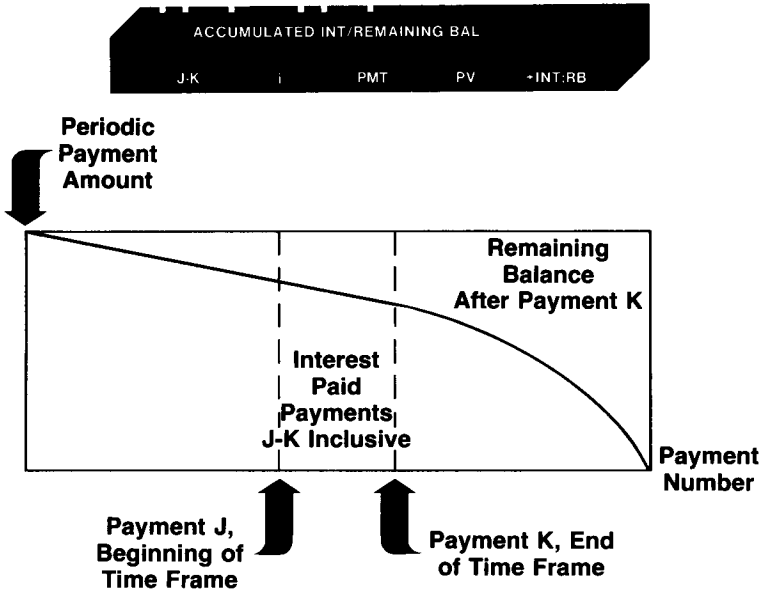


Figure 4

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

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

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

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

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

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

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

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

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

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

Example 1:

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

Keystrokes: **Outputs:**

1 A 3 A 9 ENTER↑ 12 ÷ B
167.84 C 20000 D E → 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 36th payment.

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

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

WRAP-AROUND MORTGAGE

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

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

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

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

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

Example 1:

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

Keystrokes: **Outputs:**

200000 ENTER↑ 2030.21 ENTER↑
144 A → 144.00

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

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

Now calculate the yield.

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

Note:

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

Example 2:

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

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

CONSTANT PAYMENT TO PRINCIPAL LOAN AMORTIZATION SCHEDULE

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

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

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

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

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

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

Example 1:

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

Keystrokes:

Outputs:

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

R/S → 13000.00 (total 1st payment)

R/S → 95000.00 (remaining balance)

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

Example 2:

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

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

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

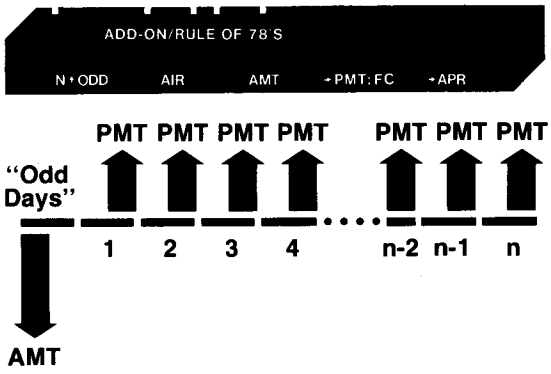


Figure 5

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

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

Note:

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

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

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

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

Example 1:

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

Keystrokes: **Outputs:**

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

R/S → 640.36 (total finance charge)

E → 10.89 (10.89% APR)

Example 2:

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

Keystrokes: **Outputs:**

30 f A 25 f B

39.33 f C

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

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

SAVINGS PLAN—LEASES

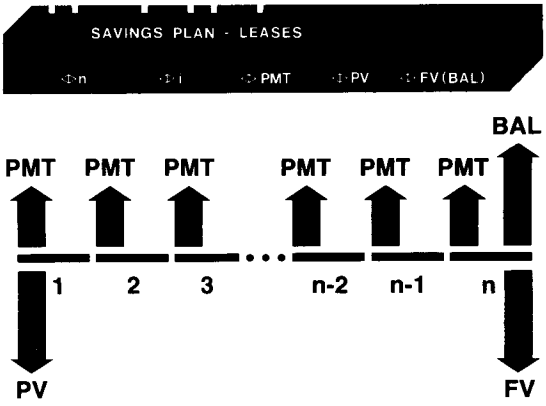


Figure 6

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

The following variables may be inputs or outputs:

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

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

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

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

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

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

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

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

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

Example 1:

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

Keystrokes: **Outputs:**

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

Example 2:

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

Keystrokes: **Output:**

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

Example 3:

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

Keystrokes: **Outputs:**

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

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

Now find the present value of the annuity today.

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

Example 4:

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

Keystrokes: **Outputs:**

f A 6 B 2500 C 40000 D

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

Example 5:

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

Keystrokes: **Outputs:**

First find the annual interest rate of the lease option.

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

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

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

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

ADVANCE PAYMENTS

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

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

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

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

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

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

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

Example 1:

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

Keystrokes: **Outputs:**

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

Example 2:

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

Keystrokes: **Outputs:**

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

SAVINGS-COMPOUNDING PERIODS DIFFERENT FROM PAYMENT PERIODS

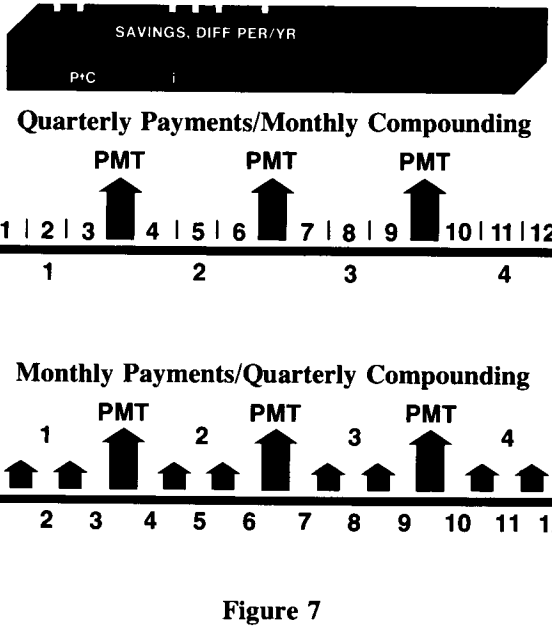


Figure 7

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

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

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

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

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

Example 1:

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

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

Example 2:

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

Keystrokes:		**Outputs:**	
100 f C f E	→	3372.20	(amount after 7 years)

Example 3:

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

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

SIMPLE INTEREST/INTEREST CONVERSIONS

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

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

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

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

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

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

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

Example 1:

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

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

E → 591.78 (interest, 365 day basis)

+ → 30591.78 (final amount, 365 day basis)

Example 2:

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

Keystrokes: **Outputs:**

4 f A 13 f C f B → 12.41 (% nominal interest rate)

Example 3:

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

Keystrokes: **Outputs:**

5 f D f E → 5.13 (an annual effective rate of 5.13%)

Example 4:

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

Keystrokes: **Outputs:**

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

DEPRECIATION SCHEDULES

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

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

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

Straight Line Depreciation

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

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

Sum of the Years' Digits Depreciation

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

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

Variable Rate Declining Balance Depreciation

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

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

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

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

Crossover Point

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

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

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

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

2. Use f C to generate a declining balance depreciation schedule for the early years up to and including the year indicated as being the "last year". Since the same input values are used, only a value for YR (D) need be keyed in before pressing f C.

3. Now use f A to generate a straight line depreciation schedule for the remaining years. The remaining book value at the end of the last "declining balance year" is keyed in for starting book value (A), and the remaining life is keyed in for the asset's life (C). There is no need to enter the salvage value as it has been retained throughout this process.

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

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

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

Example 1:

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

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

Now jump ahead to the 15th year.

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

R/S →	16829.27	(total depreciation to date)

Jump ahead to the 15th year.

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

Declining Balance

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

Keystrokes:	**Outputs:**	

Now jump to the 15th year.

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

Example 2:

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

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

Note:

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

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

etc.

DAYS BETWEEN DATES

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

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

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

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

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

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

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

Example 1:

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

Keystrokes: **Outputs:**

6.241974 A 12.051985 B C ⟶ 4182.00 (actual)

Example 2:

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

Keystrokes: **Outputs:**

3.211990 B C ⟶ 5749.00 (actual)

Example 3:

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

Keystrokes: **Outputs:**

5.011975 A 11.011980 B C ⟶ 2011.00 (actual)

D ⟶ 1980.00 (30/360)

BOND PRICE AND YIELD

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

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

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

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

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

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

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

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

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

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

Example 1:

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

Keystrokes: **Outputs:**

Enter program BD-14

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

Now enter program BD-15

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

Example 2:

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

Keystrokes: **Outputs:**

Enter program BD-14

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

Enter program BD-15

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

Example 3:

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

Keystrokes: **Outputs:**

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

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

Example 4:

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

Keystrokes: **Outputs:**

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

Example 5:

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

Keystrokes: **Outputs:**

Enter program BD-14

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

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

360 ÷ ⟶ 9.92 (number of annual coupon periods)

Enter program BD-15

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

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

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

Example 6:

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

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

Example 7:

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

Keystrokes:	Outputs:	
First, calculate and enter the after tax value of the coupon.		
5 ENTER↑ ENTER↑ .4 × − B →	3.00	(net after tax coupon)
Now calculate and enter the net after tax proceeds when the bond is redeemed for 100 at maturity.		
100 ENTER↑ ENTER↑ 99 − →	1.00	(capital gain)
.25 × →	0.25	(capital gains tax)
− D →	99.75	(net proceeds from bond redemption)
(The price and remaining coupon periods have been retained from the previous calculation.)		
C →	3.06	(% after tax yield)

INTEREST AT MATURITY/DISCOUNTED SECURITIES

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

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

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

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

Example 1:

Find the yield of the following interest at maturity security:

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

Keystrokes: **Outputs:**

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

Example 2:

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

Keystrokes: **Output:**

7 D E ⟶ 99.33 (price)

Example 3:

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

DSM = 81
DR = 5.60

Keystrokes: **Outputs:**

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

Example 4:

Find the yield of the following discounted security:

DSM = 307
Price = 96.27

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

LINEAR REGRESSION—EXPONENTIAL CURVE FIT

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

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

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

$$y = a + bx$$

where:

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

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

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

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

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

where:

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

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

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

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

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

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

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

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

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

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

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

Example 1:

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

Keystrokes: **Outputs:**

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

A ⟶	0.00
47500 C ⟶	1.00

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

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

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

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

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

Example 2:

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

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

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

The exponential curve gives a better fit.

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

MULTIPLE LINEAR REGRESSION

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

$$z = a + bx + cy$$

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

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

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

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

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

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

Example 1:

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

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

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

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

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

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

BREAK-EVEN ANALYSIS

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

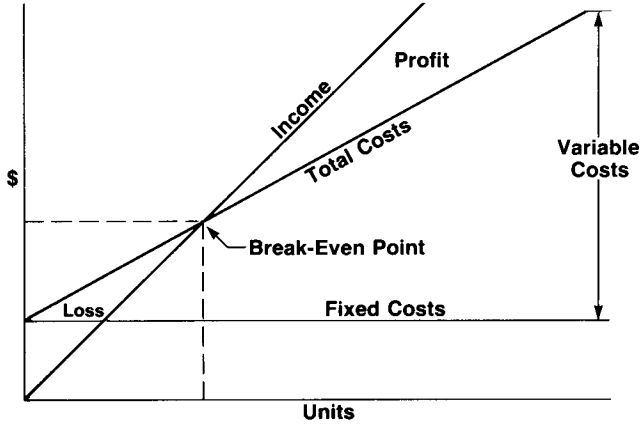


Figure 8

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

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

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

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

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

Example 1:

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

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

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

Example 2:

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

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

INVOICING

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

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

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

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

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

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

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

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

Example 1:

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

Bill 1 (2% discount if paid today)

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

Bill 2 (2% discount if paid today)

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

Bill 3 (3% discount if paid today)

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

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

PAYROLL

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

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

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

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

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

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

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

Note:

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

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

R_0 → Gross pay to date
R_3 → Federal withholdings to date
R_4 → State withholdings to date
R_5 → FICA to date
R_6 → SDI to date
R_7 → Constant 1 (Health Insurance)
R_8 → Constant 2 (Stock Plan (%))
R_A → Constant 3 (United Fund)
R_B → Number of exemptions
R_C → Hourly wage
R_D → Overtime wage
R_E → Marital status
.1 ⟷ Single
.2 ⟷ Married
R_I → Social Security Number

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

1. Set the PRGM-RUN switch to RUN.

2. Key the data into the appropriate storage registers.

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

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

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

The following example illustrates the use of this program.

Example 1:

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

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

Table 1

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

To make a data card for Ms. Waters:

Keystrokes: **Outputs:**

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

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

Insert an unclipped blank magnetic card.

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

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

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

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

To find the net pay:

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

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

	→	105.32	(Net pay)

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

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

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

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

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

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

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

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

INVENTORY

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

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

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

PRICE — stores price of parts received

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

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

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

MIN — stores minimum quantity

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

LIST — recalls and displays inventory information

UPDATE — asks for data card to record new inventory information

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

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

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

R_0 ——→ Part number (10 digit maximum)

R_1 ——→ Unit price

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

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

The following report illustrates how this program might be used.

Inventory Report
February 15, 1976

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

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

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

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

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

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

Part #	Unit Price	Amount Received
2417126	10.25	150

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

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

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

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

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

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

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

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

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

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

PROGRAM LISTINGS

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

INTERNAL RATE OF RETURN

001	*LBLA	21 11	Clear registers	
002	CLRG	16-53		
003	P≠S	16-51		
004	CLRG	16-53	INV→R_E	
005	STOE	35 15		
006	CF0	16 22 00	Clear flags	
007	CF1	16 22 01		
008	RTN	24		
009	*LBLB	21 12		
010	2	02	Input largest cash flow if #CF_s > 22.	
011	x	-35		
012	STO0	35 00		
013	RCLE	36 15		
014	X≠Y	-41		
015	÷	-24	INV/2 CMAX→R_E	
016	STOE	35 15		
017	LSTX	16-63		
018	SF0	16 21 00	Flag 0 indicates > 22 cash flows.	
019	2	02		
020	÷	-24		
021	RTN	24		
022	*LBLC	21 13		
023	ISZI	16 26 46	If F0, pack data in registers.	
024	F0?	16 23 00		
025	GSBc	23 16 13		
026	ST+i	35-55 45		
027	X≠Y	-41		
028	RCLI	36 46	Display # of cash flows (add if > 22 CF).	
029	F1?	16 23 01		
030	+	-55		
031	RTN	24		
032	*LBLc	21 16 13		
033	2	02		
034	3	03		
035	RCLI	36 46		
036	X≠Y?	16-32	23rd cash flow?	
037	GTO0	22 00		
038	1	01	Reset I	
039	STOI	35 46		
040	+	-55	Drop stack and clear x.	
041	CLX	-51		
042	EEX	-23		
043	5	05	2 CMAX/10^5→R_0	
044	ST÷0	35-24 00		
045	SF1	16 21 01		
046	*LBL0	21 00		
047	R↓	-31		
048	1	01		
049	-	-45		
050	X≠Y	-41	Scale cash flow	
051	RCL0	36 00		
052	÷	-24	If CF_j, j > 22, drop fractional part of CF_j.	
053	F1?	16 23 01		
054	INT	16 34		
055	RTN	24		
056	*LBLa	21 16 11		
057	RCLI	36 46	LBL fa sets up I for count down *and* keeps track of original # of cash flows by storing N.N.	
058	1	01		
059	0	00		
060	1	01		
061	x	-35		
062	STOI	35 46		
063	RTN	24		
064	*LBLe	21 16 15		
065	F0?	16 23 00	Unpacks double-stored cash flows.	
066	GTO0	22 00		
067	INT	16 34		
068	EEX	-23		
069	5	05		
070	÷	-24		
071	RTN	24		
072	*LBL0	21 00		
073	FRC	16 44		
074	RTN	24		
075	*LBLD	21 14		
076	GSBa	23 16 11	Set-up I	
077	RCLI	36 46	NN	
078	EEX	-23		
079	2	02		
080	÷	-24		
081	STOI	35 46	N.N→I	
082	1	01		
083	.	-62		
084	0	00		
085	1	01	$1 + i_0 \rightarrow R_D$	
086	STOD	35 14		
087	*LBL4	21 04		
088	CF0	16 22 00		
089	0	00		
090	STO0	35 00		
091	*LBL5	21 05		
092	RCLI	36 46		
093	INT	16 34		
094	F1?	16 23 01	Get j	
095	GSBd	23 16 14		
096	RCLi	36 45		
097	F1?	16 23 01		
098	GSBe	23 16 15	Unpack CF_j	
099	ST+0	35-55 00		
100	x	-35		
101	+	-55	f(i) in R_0	
102	RCLD	36 14		
103	ST÷0	35-24 00		
104	÷	-24		
105	DSZI	16 25 46		
106	GTO5	22 05		
107	F1?	16 23 01		
108	GTO0	22 00		
109	*LBL6	21 06		
110	RCL0	36 00		
111	RCLE	36 15		
112	-	-45		

REGISTERS

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

A Used	B Used	C Used	D $1 + i_0$	E Used	I Used

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

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

INTERNAL RATE OF RETURN—GROUPS OF CASH FLOWS

001	*LBLA	21 11	
002	CLRG	16-53	
003	STOE	35 15	INV→R_E
004	1	01	
005	STOD	35 14	
006	X≷Y	-41	
007	RTN	24	
008	*LBLB	21 12	If LRG CF exists
009	ABS	16 31	
010	EEX	-23	
011	7	07	
012	÷	-24	
013	LOG	16 32	
014	INT	16 34	$\text{INT}\left[\log \frac{\text{LRG CF}}{10^7}\right]$
015	X<0?	16-45	
016	CLX	-51	
017	10^x	16 33	
018	STOD	35 14	
019	RCLE	36 15	
020	X≷Y	-41	INV/10^k→R_E
021	÷	-24	
022	STOE	35 15	k = 1 or 2
023	RTN	24	
024	*LBLC	21 13	
025	ISZI	16 26 46	Scaling routine
026	RCLC	36 13	
027	X≷Y	-41	
028	+	-55	
029	STOC	35 13	
030	CLX	-51	
031	LSTX	16-63	
032	X	-35	
033	ST+0	35-55 00	$\Sigma n_j\ CF_j$
034	LSTX	16-63	
035	÷	-24	
036	LSTX	16-63	
037	EEX	-23	
038	2	02	
039	÷	-24	
040	X≷Y	-41	
041	RCLD	36 14	
042	÷	-24	
043	INT	16 34	
044	X<0?	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	GSB5	23 05	
053	ENT↑	-21	
054	ABS	16 31	
055	÷	-24	
056	X	-35	

057	STOi	35 45	$CF_j \cdot n_j$→R(i)
058	RCLI	36 46	
059	CF0	16 22 00	
060	RTN	24	
061	*LBLd	21 16 14	Routine to sum cash flows and recall number of groups before going to iteration routine.
062	GSB3	23 03	
063	0	00	
064	STOC	35 13	
065	GTO7	22 07	
066	*LBLD	21 14	
067	RCLI	36 46	
068	GSB3	23 03	
069	*LBL7	21 07	
070	1	01	
071	.	-62	1 + Initial guess
072	0	00	
073	1	01	
074	GSBe	23 16 13	
075	GTO8	22 00	
076	*LBL1	21 01	
077	RCL0	36 00	
078	GSBe	23 16 15	
079	STOC	35 13	
080	*LBL0	21 00	The secant method is used to evaluate f(i).
081	RCLB	36 12	
082	RCL0	36 00	
083	STOB	35 12	
084	-	-45	
085	RCLD	36 14	
086	RCLC	36 13	
087	STOD	35 14	
088	-	-45	
089	÷	-24	
090	x	-35	
091	ST-0	35-45 00	
092	RCL0	36 00	
093	÷	-24	
094	RND	16 24	
095	X≠0?	16-42	
096	GTO1	22 01	
097	RCL0	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	1.01 (# groups)
106	.	-62	
107	0	00	
108	1	01	
109	x	-35	→R_I
110	STOI	35 46	
111	RTN	24	
112	*LBLe	21 16 13	

REGISTERS

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

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

LABELS

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

FLAGS

0
1
2
3

SET STATUS

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

DISCOUNTED CASH FLOW ANALYSIS
NET PRESENT VALUE

001	*LBLA	21 11				057	*LBLe	21 16 15			
002	CHS	-22				058	F0?	16 23 00			
003	STOA	35 11				059	GTO1	22 01			
004	0	00				060	SF0	16 21 00			
005	STO9	35 09				061	1	01			
006	1	01				062	RTN	24			
007	STOC	35 13				063	*LBL1	21 01			
008	RCLA	36 11				064	0	00			
009	CHS	-22				065	CF0	16 22 00			
010	GSB9	23 09				066	RTN	24			
011	RTN	24				067	*LBL9	21 09			
012	*LBLB	21 12	i/100→R_B			068	F0?	16 23 00			
013	EEX	-23				069	GTO2	22 02			
014	2	02				070	R/S	51			
015	÷	-24				071	RTN	24			
016	STOB	35 12				072	*LBL2	21 02			
017	LSTX	16-63				073	PRTX	-14			
018	×	-35				074	R/S	51			
019	RTN	24									
020	*LBLC	21 13	#→R_C								
021	STOC	35 13									
022	RTN	24									
023	*LBLD	21 14									
024	STOD	35 14									
025	1	01									
026	RCLB	36 12									
027	+	-55	Calculate present value of series.								
028	RCLC	36 13									
029	ST+9	35-55 09									
030	Y^x	31									
031	STOE	35 15									
032	RCLA	36 11									
033	×	-35									
034	RCLE	36 15									
035	1	01									
036	-	-45									
037	RCLB	36 12									
038	÷	-24									
039	RCLD	36 14									
040	×	-35									
041	+	-55									
042	STOA	35 11									
043	1	01									
044	RCLB	36 12									
045	+	-55									
046	RCL9	36 09									
047	Y^x	31									
048	÷	-24									
049	1	01									
050	STOC	35 13									
051	R↓	-31	Reset n to 1.								
052	GSB9	23 09									
053	RTN	24									
054	*LBLE	21 15									
055	RCL9	36 09	Recall Σn								
056	RTN	24									

-NPV→R_A
0→R_9
1→R_C

Print option

REGISTERS

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

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

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

DIRECT REDUCTION LOANS
SINKING FUND

001	*LBLA	21 11		
002	STOA	35 11	$n \rightarrow R_A$	
003	F3?	16 23 03	Digit entered?	
004	RTN	24		
005	GSB0	23 00		
006	RCLE	36 15	Solve for n and store in R_A.	
007	LSTX	16-63		
008	-	-45		
009	RCL0	36 14		
010	LSTX	16-63		
011	-	-45		
012	÷	-24		
013	LN	32		
014	RCL7	36 07		
015	LN	32		
016	÷	-24		
017	STOA	35 11		
018	RTN	24		
019	*LBLC	21 13	$PMT \rightarrow R_C$	
020	STOC	35 13	Digit entered?	
021	F3?	16 23 03		
022	RTN	24		
023	1	01	Store dummy 1 for PMT.	
024	STOC	35 13		
025	GSB0	23 00		
026	1/X	52	Solve for PMT and store in R_C.	
027	RCL0	36 14		
028	R↑	16-31		
029	-	-45		
030	x	-35		
031	STOC	35 13		
032	RTN	24		
033	*LBL0	21 14	$PV \rightarrow R_D$	
034	STOD	35 14	Digit entered?	
035	F3?	16 23 03		
036	RTN	24		
037	GSB0	23 00	Solve for PV and store in R_D.	
038	+	-55		
039	STOD	35 14		
040	RTN	24		
041	*LBLE	21 15	$FV(BAL) \rightarrow R_E$	
042	STOE	35 15	Digit entered?	
043	F3?	16 23 03		
044	RTN	24		
045	GSB0	23 00		
046	RCL0	36 14	Solve for FV(BAL) and	
047	X≠Y	-41	store in R_E.	
048	-	-45		
049	RCL8	36 08		
050	÷	-24		
051	STOE	35 15		
052	RTN	24		
053	*LBL0	21 00	Clear FV(BAL) flag.	
054	CF1	16 22 01	If PV = 0 set FV(BAL)	
055	RCL0	36 14	flag.	
056	X=0?	16-43		
057	SF1	16 21 01		
058	1	01		
059	RCL8	36 12	$i/100 \rightarrow R_9$	
060	%	55		
061	STO9	35 09		
062	+	-55	$(1 + i) \rightarrow R_7$	
063	STO7	35 07		
064	RCLA	36 11		
065	CHS	-22	$(1 + i)^{-n} \rightarrow R_8$	
066	Y^x	31		
067	STO8	35 08		
068	RCLE	36 15		
069	x	-35	$1 - (1 + i)^{-n} \rightarrow R_4$	
070	1	01		
071	RCL8	36 08		
072	-	-45		
073	STO4	35 04	Calculate	
074	RCLC	36 13	±(PMT/i)	
075	RCL9	36 09	and store in	
076	÷	-24	R_3	
077	F1?	16 23 01		
078	CHS	-22	$\pm \frac{PMT}{i}\left[1 - (1+i)^{-n}\right]$	
079	STO3	35 03		
080	x	-35		
081	RTN	24		
082	*LBLa	21 16 11	Start by clearing PMT,	
083	CLX	-51	PV, FV(BAL) registers.	
084	STOC	35 13		
085	STOD	35 14		
086	STOE	35 15		
087	RTN	24		
088	*LBL8	21 12	$i \rightarrow R_8$	
089	STO8	35 12	Digit entered?	
090	F3?	16 23 03		
091	RTN	24		
092	0	00		
093	STOB	35 12	Clear R_8 for sum of i	
094	2	02	terms.	
095	1	01	Store address of R_8 in	
096	STOI	35 46	R_I for indirect access.	
097	RCLE	36 15		
098	RCLA	36 11		
099	RCLC	36 13	Start guess of i:	
100	x	-35	n PMT + FV(BAL)	
101	+	-55		
102	RCL0	36 14	If PV = 0 GTO FV(BAL)	
103	X=0?	16-43	guess	
104	GTO3	22 03	PV guess for i:	
105	-	-45	$\frac{n\,PMT + FV(BAL) - PV}{n}$	
106	RCLA	36 11		
107	÷	-24	and recall PV.	
108	RCL0	36 14		
109	GTO4	22 04		
110	*LBL3	21 03	FV(BAL) guess for i	
111	RCLE	36 15	numerator:	
112	LSTX	16-63		

REGISTERS

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

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

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

LABELS

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

FLAGS

0	
1 PV = 0	
2	
3 Digit?	

SET STATUS

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

ACCUMULATED INTEREST/REMAINING BALANCE

001	*LBLA	21 11	
002	RCL0	36 00	
003	STO7	35 07	J→R7
004	X≷Y	-41	K→R0
005	STO0	35 00	
006	RTN	24	
007	*LBLB	21 12	
008	EEX	-23	
009	2	02	i/100→R1
010	÷	-24	
011	STO1	35 01	
012	LSTX	16-63	
013	×	-35	
014	RTN	24	
015	*LBLC	21 13	
016	STO2	35 02	PMT→R2
017	RTN	24	
018	*LBLD	21 14	
019	STO3	35 03	
020	RTN	24	PV→R3
021	*LBLE	21 15	
022	RCL0	36 00	
023	RCL7	36 07	
024	X≤Y?	16-35	
025	GTO0	22 00	
026	STO0	35 00	
027	R↓	-31	
028	STO7	35 07	
029	*LBL0	21 00	
030	1	01	
031	RCL1	36 01	
032	+	-55	(1 + i/100)→R8
033	STO8	35 08	
034	RCL0	36 00	
035	GSB1	23 01	BALK→R4
036	STO4	35 04	
037	RCL8	36 08	
038	RCL7	36 07	
039	1	01	
040	-	-45	
041	GSB1	23 01	-BALJ-1
042	CHS	-22	
043	RCL4	36 04	
044	+	-55	BALK - BALJ-1→R6
045	STO6	35 06	
046	RCL0	36 00	
047	RCL7	36 07	
048	-	-45	
049	1	01	
050	+	-55	
051	RCL2	36 02	
052	×	-35	
053	+	-55	
054	RTN	24	INTJ-K
055	RCL4	36 04	BALK
056	R/S	51	

057	*LBLa	21 16 11	
058	RCL7	36 07	
059	F0?	16 23 00	
060	SPC	16-11	
061	GSB9	23 09	J
062	1	01	
063	RCL1	36 01	
064	+	-55	
065	STO8	35 08	
066	RCL7	36 07	
067	GSB1	23 01	
068	STO4	35 04	
069	RCL8	36 08	
070	RCL7	36 07	
071	1	01	
072	-	-45	
073	GSB1	23 01	
074	RCL4	36 04	
075	-	-45	
076	STO6	35 06	
077	RCL2	36 02	
078	X≷Y	-41	
079	-	-45	INTJ
080	GSB9	23 09	
081	RCL6	36 06	
082	GSB9	23 09	PRINCJ
083	RCL4	36 04	
084	GSB9	23 09	RBALJ
085	RCL7	36 07	
086	RCL2	36 02	
087	×	-35	
088	RCL3	36 03	
089	RCL4	36 04	
090	-	-45	
091	-	-45	
092	GSB9	23 09	TOT INT
093	1	01	
094	ST+7	35-55 07	
095	RCL0	36 00	
096	RCL7	36 07	
097	X≤Y?	16-35	J≤K?
098	GTOa	22 16 11	
099	RTN	24	
100	*LBL1	21 01	
101	CHS	-22	
102	Y^x	31	
103	STO5	35 05	
104	1	01	
105	-	-45	
106	RCL1	36 01	
107	÷	-24	
108	RCL2	36 02	
109	×	-35	
110	RCL3	36 03	
111	+	-55	
112	RCL5	36 05	

REGISTERS

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

A	B	C	D	E	I

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

RND may be inserted here.

Print mode option.

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

WRAP-AROUND MORTGAGE

001	*LBLA	21 11	$-n_1 \rightarrow R_1$
002	CLRG	16-53	$PMT_1 \rightarrow R_3$
003	CHS	-22	$-PV_1 \rightarrow R_5$
004	STO1	35 01	
005	R↓	-31	
006	STO3	35 03	
007	R↓	-31	
008	CHS	-22	
009	STO5	35 05	
010	RCL1	36 01	
011	CHS	-22	
012	RTN	24	
013	*LBLC	21 13	
014	CHS	-22	$-n_2 \rightarrow R_2$
015	STO2	35 02	$PMT_2 \rightarrow R_4$
016	R↓	-31	$PV_2 - PV_1 \rightarrow R_5$
017	STO4	35 04	
018	R↓	-31	
019	ST+5	35-55 05	
020	RCL2	36 02	
021	CHS	-22	
022	RTN	24	
023	*LBLD	21 14	$BAL \rightarrow R_0$
024	STO0	35 00	
025	RTN	24	
026	*LBLE	21 15	
027	EEX	-23	Initial guess
028	CHS	-22	$i \rightarrow R_6$
029	3	03	
030	STO6	35 06	
031	*LBL0	21 00	
032	1	01	Newton's method is used to
033	RCL6	36 06	find i.
034	1	01	
035	+	-55	
036	STO7	35 07	
037	RCL2	36 02	
038	Y^x	31	
039	STO9	35 09	
040	-	-45	
041	RCL4	36 04	
042	x	-35	
043	1	01	
044	RCL7	36 07	
045	RCL1	36 01	
046	Y^x	31	
047	STO8	35 08	
048	-	-45	
049	RCL3	36 03	
050	x	-35	
051	-	-45	
052	STOE	35 15	
053	RCL9	36 09	
054	RCL0	36 00	
055	x	-35	
056	RCL6	36 06	

057	x	-35	
058	+	-55	
059	RCL5	36 05	
060	RCL6	36 06	
061	x	-35	
062	-	-45	f(x)
063	STO1	35 46	
064	RCL8	36 08	
065	RCL1	36 01	
066	x	-35	
067	RCL3	36 03	
068	x	-35	
069	RCL9	36 09	
070	RCL2	36 02	
071	x	-35	
072	RCL4	36 04	
073	x	-35	
074	-	-45	
075	RCL7	36 07	
076	÷	-24	
077	RCLE	36 15	
078	RCL6	36 06	
079	÷	-24	
080	-	-45	
081	RCL0	36 00	
082	RCL2	36 02	
083	x	-35	
084	RCL6	36 06	
085	x	-35	
086	RCL9	36 09	
087	x	-35	
088	RCL7	36 07	
089	÷	-24	
090	+	-55	f(x)/f'(x)
091	÷	-24	
092	ST-6	35-45 06	
093	ABS	16 31	
094	EEX	-23	Is this within desired
095	CHS	-22	range? If not, go to 0.
096	6	06	Otherwise multiply by
097	X≠Y?	16-35	100 and display periodic
098	GTO0	22 00	yield.
099	RCL6	36 06	
100	EEX	-23	
101	2	02	
102	x	-35	
103	RTN	24	
104	*LBLa	21 16 11	
105	STOA	35 11	$n \rightarrow R_A$
106	RTN	24	
107	*LBLb	21 16 12	
108	EEX	-23	$i/100 \rightarrow R_B$
109	2	02	
110	÷	-24	
111	STOB	35 12	
112	LSTX	16-63	

REGISTERS

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

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

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

PV→R_D

Calculate PMT and store in R_C.

LABELS					FLAGS
A n_1,PMT_1,PV_1	B	C n_2,PMT_2,PV_2	D BAL	E →i	0
a n	b i	c →PMT	d PV	e	1
0	1	2	3	4	2
5	6	7	8	9	3

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

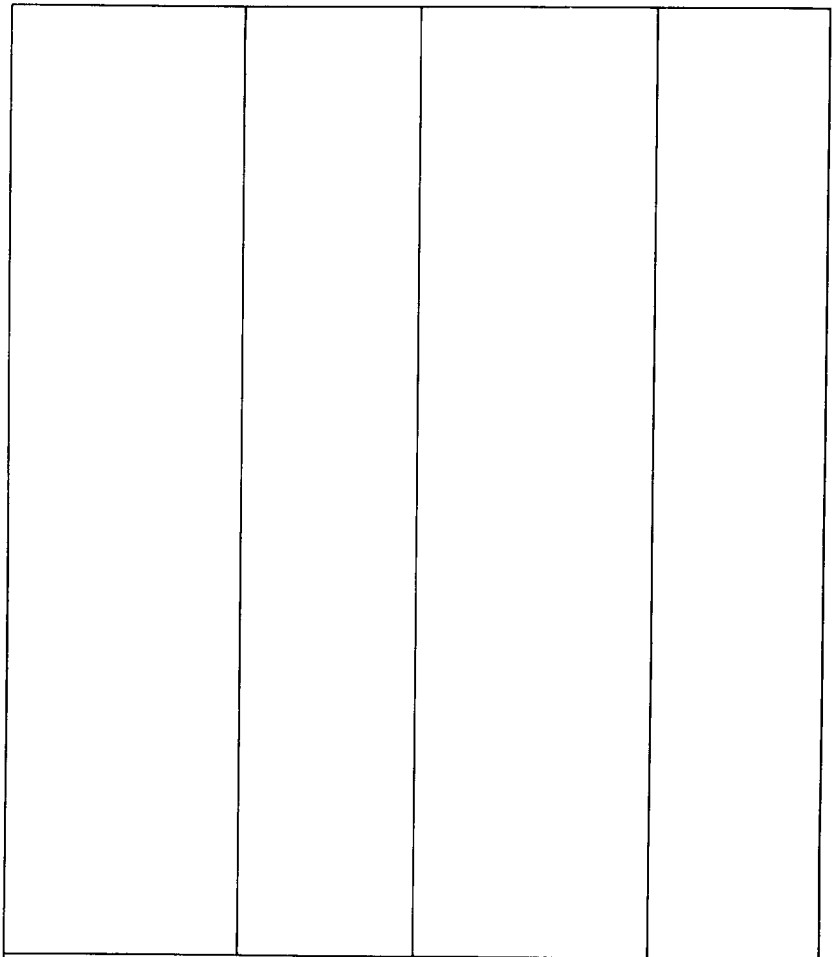
CONSTANT PAYMENT TO PRINCIPAL LOAN AMORTIZATION SCHEDULE

001	*LBLA	21 11	
002	CF1	16 22 01	
003	STO0	35 00	$K \rightarrow R_0$
004	GSB9	23 09	
005	RTN	24	
006	*LBLB	21 12	
007	EEX	-23	$i/100 \rightarrow R_B$
008	2	02	
009	÷	-24	
010	STOB	35 12	
011	LSTX	16-63	
012	×	-35	
013	RTN	24	
014	*LBLC	21 13	
015	STOC	35 13	$CPMT \rightarrow R_C$
016	RTN	24	
017	*LBLD	21 14	
018	STOD	35 14	$PV \rightarrow R_D$
019	RTN	24	
020	*LBLE	21 15	
021	RCLD	36 14	
022	RCLC	36 13	
023	RCL0	36 00	
024	×	-35	
025	-	-45	
026	STOE	35 15	$RBAL \rightarrow R_E$
027	RCLC	36 13	
028	+	-55	
029	RCLB	36 12	
030	×	-35	
031	STO9	35 09	$PMT_i \rightarrow R_9$
032	1	01	Increment for next period.
033	ST+0	35-55 00	
034	RCL9	36 09	
035	GSB9	23 09	INT
036	RCLC	36 13	
037	+	-55	
038	GSB9	23 09	TOT PMT
039	RCLE	36 15	
040	GSB9	23 09	RBAL
041	*LBL0	21 00	
042	2	02	$\left[\frac{-}{\frac{(2-K)\,CPMT}{PV}+2}{2}\right]$
043	RCL0	36 00	
044	-	-45	
045	RCLC	36 13	
046	×	-35	
047	RCLD	36 14	
048	÷	-24	
049	2	02	
050	+	-55	
051	2	02	
052	÷	-24	
053	RCL0	36 00	
054	1	01	
055	-	-45	
056	×	-35	

057	RCLB	36 12	
058	×	-35	
059	RCLD	36 14	
060	×	-35	
061	F1?	16 23 01	
062	RTN	24	
063	GSB9	23 09	TOT INT
064	RCLD	36 14	
065	RCLC	36 13	
066	÷	-24	Is loan paid off?
067	RCL0	36 00	
068	X>Y?	16-34	
069	RTN	24	
070	SPC	16-11	
071	GSB9	23 09	
072	GTOE	22 15	
073	*LBL0	21 16 11	
074	SF1	16 21 01	$K \rightarrow R_0$
075	STO0	35 00	$J \rightarrow R_8$
076	X<>Y	-41	
077	STO0	35 00	
078	1	01	
079	ST+0	35-55 00	
080	GSB0	23 00	$TOT\ INT_{K+1}$
081	STOI	35 46	
082	RCL0	36 00	
083	STO0	35 00	
084	GSB0	23 00	$TOT\ INT_J$
085	RCLI	36 46	
086	X<>Y	-41	
087	-	-45	
088	GSB9	23 09	$TOT\ INT_{K+1} - TOT\ INT_J$
089	RTN	24	
090	*LBLe	21 16 15	
091	F0?	16 23 00	Print/pause flag
092	GTO1	22 01	
093	SF0	16 21 00	
094	1	01	
095	RTN	24	
096	*LBL1	21 01	
097	0	00	
098	CF0	16 22 00	
099	RTN	24	
100	*LBL9	21 09	
101	F0?	16 23 00	Print/pause routine.
102	GTO2	22 02	
103	R/S	51	
104	RTN	24	
105	*LBL2	21 02	
106	PRTX	-14	
107	RTN	24	
108	R/S	51	

REGISTERS

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



LABELS				
A K	B i	C CPMT	D PV	E SKED
a J↑K	b I	c	d	e Print?
0 Used	1 Used	2 Used	3	4
5	6	7	8	9 Used

FLAGS
0 Print?
1
2
3

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

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

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

REGISTERS

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

A	B	C	D	E	I

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

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

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

SAVINGS PLAN—LEASES

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

REGISTERS

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

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

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

LABELS

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

FLAGS

0	
1	PV = 0
2	
3	Digit?

SET STATUS

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

ADVANCE PAYMENTS

001	*LBLA	21 11	
002	STO1	35 01	A→R1
003	X≷Y	-41	-n→R0
004	CHS	-22	
005	STO0	35 00	
006	CHS	-22	
007	X≷Y	-41	
008	X>Y?	16-34	A > n?
009	GTO2	22 02	
010	RTN	24	
011	*LBLD	21 14	
012	STO4	35 04	PV→R4
013	RTN	24	
014	*LBLE	21 15	
015	STO5	35 05	RESID→R5
016	RTN	24	
017	*LBLc	21 16 13	- - - - - - - - - - - -
018	EEX	-23	i/100→R2
019	2	02	
020	÷	-24	
021	STO2	35 02	
022	1	01	
023	+	-55	(1 + i/100)→R7
024	STO7	35 07	
025	RCL0	36 00	
026	Y^x	31	
027	RCL5	36 05	
028	x	-35	
029	RCL4	36 04	Calculate PMT
030	X≷Y	-41	
031	-	-45	
032	RCL7	36 07	
033	RCL0	36 00	
034	RCL1	36 01	
035	+	-55	
036	Y^x	31	
037	1	01	
038	X≷Y	-41	
039	-	-45	
040	RCL2	36 02	
041	÷	-24	
042	RCL1	36 01	
043	+	-55	
044	÷	-24	
045	RTN	24	
046	*LBLb	21 16 12	- - - - - - - - - - - -
047	STO3	35 03	PMT→R3
048	EEX	-23	
049	CHS	-22	
050	3	03	
051	STO2	35 02	
052	*LBL0	21 00	
053	1	01	Calculate f(i)
054	RCL2	36 02	
055	+	-55	
056	STO7	35 07	
057	RCL0	36 00	
058	RCL1	36 01	
059	+	-55	
060	Y^x	31	
061	1	01	
062	X≷Y	-41	
063	-	-45	
064	RCL2	36 02	
065	÷	-24	
066	RCL1	36 01	
067	+	-55	
068	RCL3	36 03	
069	x	-35	
070	RCL7	36 07	
071	RCL0	36 00	
072	Y^x	31	
073	RCL5	36 05	
074	x	-35	
075	+	-55	
076	RCL4	36 04	
077	-	-45	
078	STO6	35 06	- - - - - - - - - - - -
079	RCL7	36 07	Calculate f'(i)
080	RCL0	36 00	
081	RCL1	36 01	
082	+	-55	
083	1	01	
084	-	-45	
085	Y^x	31	
086	RCL0	36 00	
087	CHS	-22	
088	RCL1	36 01	
089	-	-45	
090	x	-35	
091	RCL2	36 02	
092	x	-35	
093	RCL7	36 07	
094	RCL0	36 00	
095	RCL1	36 01	
096	+	-55	
097	Y^x	31	
098	1	01	
099	X≷Y	-41	
100	-	-45	
101	-	-45	
102	RCL2	36 02	
103	X^2	53	
104	÷	-24	
105	RCL3	36 03	
106	x	-35	
107	RCL7	36 07	
108	RCL0	36 00	
109	1	01	
110	-	-45	
111	Y^x	31	
112	RCL5	36 05	

REGISTERS

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

A	B	C	D	E	I

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

LABELS					FLAGS	SET STATUS		
A n, A	B	C	D PV	E RESID	0	FLAGS	TRIG	DISP
a	b →i	c →PMT	d	e	1	ON OFF 0 ☐ ☒ 1 ☐ ☒	DEG ☒	FIX ☒
0 Used	1	2 Used	3	4	2	2 ☐ ☒	GRAD ☐	SCI ☐
5	6	7	8	9	3	3 ☐ ☒	RAD ☐	ENG ☐ n 2

SAVINGS-COMPOUNDING PERIODS DIFFERENT FROM PAYMENT PERIODS

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

REGISTERS

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

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

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

LABELS

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

FLAGS

0 P/C > 1
1
2
3 Digit?

SET STATUS

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

SIMPLE INTEREST/INTEREST CONVERSIONS

001	3	03	
002	6	06	Initialize
003	0	00	360→R_8
004	STO8	35 08	365→R_9
005	5	05	
006	+	-55	
007	STO9	35 09	
008	0	00	
009	R/S	51	
010	*LBLA	21 11	Days→R_A
011	STOA	35 11	Digit entered?
012	F3?	16 23 03	
013	RTN	24	
014	F2?	16 23 02	Test for 360 or 365 day
015	GTO0	22 00	basis
016	RCLD	36 14	
017	RCL8	36 08	
018	*LBL1	21 01	
019	×	-35	
020	RCLC	36 13	Calculate days and store in
021	÷	-24	R_A.
022	RCLB	36 12	
023	÷	-24	
024	STOA	35 11	
025	RTN	24	
026	*LBL0	21 00	
027	RCLE	36 15	365 day basis
028	RCL9	36 09	
029	GTO1	22 01	
030	*LBLB	21 12	RATE/100→R_B
031	EEX	-23	
032	2	02	
033	÷	-24	
034	STOB	35 12	
035	LSTX	16-63	
036	×	-35	
037	F3?	16 23 03	Digit entered?
038	RTN	24	
039	F2?	16 23 02	Test for 360 or 365 day
040	GTO2	22 02	basis.
041	RCL8	36 08	
042	RCLD	36 14	
043	*LBL3	21 03	
044	×	-35	
045	RCLA	36 11	Calculate RATE and store
046	÷	-24	in R_B
047	RCLC	36 13	
048	÷	-24	
049	EEX	-23	
050	2	02	
051	×	-35	
052	STOB	35 12	
053	RTN	24	
054	*LBL2	21 02	
055	RCL9	36 09	365 day basis
056	RCLE	36 15	

057	GTO3	22 03	
058	*LBLC	21 13	BEG AMT→R_C
059	STOC	35 13	Digit entered?
060	F3?	16 23 03	
061	RTN	24	
062	F2?	16 23 02	360 or 365?
063	GTO4	22 04	
064	RCLD	36 14	
065	RCL8	36 08	
066	*LBL5	21 05	
067	×	-35	Calculate BEG AMT and
068	RCLA	36 11	store in R_C.
069	÷	-24	
070	RCLB	36 12	
071	÷	-24	
072	STOC	35 13	
073	RTN	24	
074	*LBL4	21 04	
075	RCLE	36 15	365 day basis
076	RCL9	36 09	
077	GTO5	22 05	
078	*LBLD	21 14	INT_{360}→R_D
079	STOD	35 14	
080	F3?	16 23 03	
081	RTN	24	Digit entered?
082	RCLC	36 13	
083	RCLA	36 11	Calculate INT_{360} and
084	RCL8	36 08	store in R_D.
085	GSB6	23 06	
086	STOD	35 14	
087	RTN	24	
088	*LBLE	21 15	
089	STOE	35 15	Set flag 2 for 365 day
090	SF2	16 21 02	basis.
091	F3?	16 23 03	Digit entered?
092	RTN	24	
093	RCLC	36 13	
094	RCLA	36 11	
095	RCL9	36 09	Calculate INT_{365} and
096	GSB6	23 06	store in R_E.
097	STOE	35 15	
098	RTN	24	
099	*LBL6	21 06	
100	÷	-24	
101	RCLC	36 13	
102	×	-35	
103	RCLB	36 12	
104	×	-35	
105	RTN	24	
106	*LBLa	21 16 11	C/YR→R_A
107	STOA	35 11	
108	RTN	24	
109	*LBLb	21 16 12	NOM→R_B
110	STOB	35 12	Digit entered?
111	F3?	16 23 03	
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	I

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

Calculate NOM and store in R_B.

EFF→R_C

Digit entered?

Calculate EFF and store in R_C.

Continuous

Calculate NOM and store in R_D.

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

Calculate EFF and store in R_E.

For continuous 365/360 day basis.

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

DEPRECIATION SCHEDULES

001	*LBLa	21 16 11	
002	F0?	16 23 00	Straight line
003	SPC	16-11	
004	RCLD	36 14	K
005	GSB9	23 09	
006	RCLA	36 11	$\frac{SBV - SAL}{LIFE} \rightarrow R_I$
007	RCLB	36 12	
008	-	-45	
009	RCLC	36 13	
010	÷	-24	
011	STO1	35 46	DEP
012	GSB9	23 09	
013	RCLC	36 13	
014	RCLD	36 14	
015	-	-45	(LIFE – YR) DEP = RDV_K
016	RCL1	36 46	
017	x	-35	
018	GSB9	23 09	
019	RCLB	36 12	
020	+	-55	
021	GSB9	23 09	RBV_k
022	RCL1	36 46	$\left(\frac{SBV - SAL}{LIFE}\right)$ YR = TOT DEP
023	RCLD	36 14	
024	x	-35	
025	GSB9	23 09	
026	1	01	
027	GSBD	23 14	
028	RCLC	36 13	
029	RCLD	36 14	
030	X≤Y?	16-35	K ⩽ LIFE?
031	GTOa	22 16 11	
032	RTN	24	
033	*LBLb	21 16 12	SOYD
034	F0?	16 23 00	
035	SPC	16-11	
036	RCLD	36 14	
037	GSB9	23 09	K
038	RCLA	36 11	
039	RCLB	36 12	
040	-	-45	
041	STOB	35 00	
042	RCLC	36 13	
043	GSB2	23 02	
044	STO7	35 07	$\left(\frac{LIFE+1-K}{SOYD}\right)$ (SBV–SAL)
045	RCLC	36 13	
046	1	01	
047	+	-55	
048	RCLD	36 14	
049	-	-45	
050	RCL7	36 07	
051	÷	-24	
052	RCL8	36 00	
053	x	-35	
054	GSB9	23 09	DEP_K
055	RCLC	36 13	
056	RCLD	36 14	

057	-	-45	
058	X<0?	16-45	
059	GTO3	22 03	
060	GSB2	23 02	
061	RCL7	36 07	
062	÷	-24	
063	STO4	35 04	
064	RCLB	36 00	
065	x	-35	
066	*LBL3	21 03	
067	STO6	35 06	
068	GSB9	23 09	RDV_K
069	RCLB	36 12	
070	+	-55	
071	GSB9	23 09	$RBV_K = RDV_K + SAL$
072	1	01	
073	RCL4	36 04	
074	-	-45	
075	RCLB	36 00	
076	x	-35	
077	GSB9	23 09	TOT DEP_K
078	1	01	
079	GSBD	23 14	
080	RCLC	36 13	
081	RCLD	36 14	K ⩽ LIFE?
082	X≤Y?	16-35	
083	GTOb	22 16 12	
084	RTN	24	
085	*LBL2	21 02	
086	ENT↑	-21	
087	FRC	16 44	$\frac{(1 + W)(2F + W)}{2}$
088	ENT↑	-21	
089	+	-55	
090	X≷Y	-41	
091	INT	16 34	= SOYD
092	+	-55	
093	LSTX	16-63	
094	1	01	
095	+	-55	
096	x	-35	
097	2	02	
098	÷	-24	
099	RTN	24	
100	*LBLc	21 16 13	Declining Balance
101	F0?	16 23 00	
102	SPC	16-11	
103	RCLD	36 14	
104	GSB9	23 09	K
105	GSB4	23 04	
106	RCLD	36 14	
107	1	01	
108	-	-45	
109	Y^x	31	
110	RCLA	36 11	
111	x	-35	
112	RCL8	36 00	

REGISTERS

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

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

113	x	-35		169	R/S	51	
114	STO I	35 46	DEP_K	170	RTN	24	
115	GSB 9	23 09		171	*LBL 3	21 01	
116	1	01		172	PRTX	-14	
117	RCL 7	36 07		173	RTN	24	
118	RCL D	36 14		174	*LBL d	21 16 14	Crossover point
119	Y^x	31		175	8	08	
120	-	-45		176	STO D	35 14	
121	RCL A	36 11	(SBV-SAL)-TOT DEP_K	177	GSB 4	23 04	
122	x	-35		178	*LBL 8	21 08	
123	STO 9	35 09		179	RCL 7	36 07	
124	RCL A	36 11		180	1	01	
125	RCL B	36 12		181	GSB D	23 14	
126	-	-45		182	1	01	
127	RCL 9	36 09		183	-	-45	
128	-	-45		184	Y^x	31	
129	GSB 9	23 09	RDV_K	185	RCL A	36 11	
130	RCL B	36 12		186	x	-35	
131	+	-55		187	RCL 8	36 08	
132	GSB 9	23 09	RBV_K	188	x	-35	
133	RCL 9	36 09		189	RCL 7	36 07	
134	GSB 9	23 09	TOT DEP_K	190	RCL D	36 14	
135	1	01		191	1	01	
136	GSB D	23 14		192	-	-45	
137	RCL C	36 13		193	Y^x	31	
138	RCL D	36 14	$K \leqslant$ LIFE?	194	RCL A	36 11	
139	X≤Y?	16-35		195	x	-35	
140	GTO c	22 16 13		196	RCL B	36 12	
141	RTN	24		197	-	-45	
142	*LBL D	21 14	To add to register D.	198	STO 9	35 09	
143	RCL D	36 14		199	RCL C	36 13	
144	+	-55		200	1	01	
145	STO D	35 14		201	+	-55	
146	RTN	24		202	RCL D	36 14	
147	*LBL 4	21 04		203	-	-45	
148	1	01	$FACT/LIFE \rightarrow R_8$	204	÷	-24	
149	RCL E	36 15		205	X≷Y	-41	
150	RCL C	36 13		206	X>Y?	16-34	
151	÷	-24		207	GTO 8	22 08	
152	STO 8	35 08	$1 - FACT/LIFE \rightarrow R_7$	208	RCL D	36 14	
153	-	-45		209	1	01	
154	STO 7	35 07		210	-	-45	
155	RTN	24		211	GSB 9	23 09	
156	*LBL e	21 16 15	Print/pause	212	RCL C	36 13	Last year
157	F0?	16 23 00		213	X≷Y	-41	
158	GTO 0	22 00		214	-	-45	
159	SF 0	16 21 00		215	GSB 9	23 09	
160	1	01		216	RCL 9	36 09	Remaining life
161	RTN	24		217	RCL B	36 12	
162	*LBL 0	21 00		218	+	-55	
163	0	00		219	GTO 9	22 09	
164	CF 0	16 22 00		220	R/S	51	RBV
165	RTN	24					
166	*LBL 9	21 09					
167	F0?	16 23 00					
168	GTO 1	22 01					

LABELS					FLAGS	SET STATUS		
A	B	C	D Used	E	0 Print?	FLAGS ON OFF	TRIG	DISP
a St. line	b SOYD	c DEC BAL	d CROSS	e SCHED?	1	0 ☐ ☒	DEG ☒	FIX ☒
0 Used	1 Used	2 SOYD	3 Used	4 Used	2	1 ☐ ☒	GRAD ☐	SCI ☐
5	6	7	8 Used	9 Used	3	2 ☐ ☒	RAD ☐	ENG ☐
						3 ☐ ☒		n 2

DAYS BETWEEN DATES

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

REGISTERS

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

A	B	C	D	E	I

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

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

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

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	STO8	35 08	-PER→R_0	060	ABS	16 31	Has limit been reached?		
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	GTO1	22 01			
010	STO3	35 03	100→R_3	066	F2?	16 23 02			
011	R↓	-31		067	GTO2	22 02			
012	STO1	35 01	CR→R_1	068	RCL6	36 06			
013	RTN	24		069	GTO3	22 03			
014	*LBLD	21 14		070	*LBL2	21 02			
015	CF3	16 22 03	RV→R_3	071	RCL5	36 05			
016	STO3	35 03		072	1	01	Modify price for next set of iterations.		
017	RTN	24		073	RCL0	36 00			
018	*LBLC	21 13		074	FRC	16 44			
019	F3?	16 23 03	YLD→R_2	075	+	-55			
020	GTO5	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	GTO8	22 00		081	x	-35			
026	SF2	16 21 02		082	RCL6	36 06			
027	RCL1	36 01	Calculate initial guess	083	x	-35			
028	2	02		084	-	-45			
029	÷	-24		085	STO5	35 05			
030	RCL4	36 04		086	GTO1	22 01			
031	STO5	35 05		087	*LBL0	21 00			
032	÷	-24		088	RCL3	36 03	Calculate yield if less than 1 coupon period remaining.		
033	STO6	35 06		089	RCL1	36 01			
034	*LBL1	21 01		090	2	02			
035	1	01	Calculate f(y)	091	÷	-24			
036	RCL3	36 03		092	+	-55			
037	RCL5	36 05		093	LSTX	16-63			
038	÷	-24		094	RCL0	36 00			
039	1	01		095	1	01			
040	RCL6	36 06		096	+	-55			
041	+	-55		097	x	-35			
042	RCL0	36 00		098	RCL4	36 04			
043	Y^x	31		099	+	-55			
044	STO8	35 08		100	÷	-24			
045	x	-35		101	1	01			
046	-	-45		102	-	-45			
047	RCL6	36 06		103	RCL0	36 00			
048	x	-35		104	CHS	-22			
049	1	01		105	÷	-24			
050	RCL0	36 00		106	*LBL3	21 03	Display answer if second time through.		
051	-	-45		107	2	02			
052	÷	-24		108	0	00			
053	RCL1	36 01		109	0	00			
054	2	02		110	x	-35			
055	÷	-24		111	STO2	35 02			
056	RCL5	36 05		112	RTN	24			

REGISTERS

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

A	B	C	D	E	I

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

LABELS

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

FLAGS

0	1
2 Used	3 Digit?

SET STATUS

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

INTEREST AT MATURITY/DISCOUNTED SECURITIES

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

REGISTERS

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

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

```
113      ÷          -24
114    RCLA       36 11
115      ÷          -24
116      3            03
117      .          -62
118      6            06
119    EEX          -23
120      4            04
121      ×          -35
122   STOD       35 14
123    RTN          24
124   *LBLd   21 16 14
125     F1?   16 23 01
126    GTO2       22 02
127   STOD       35 14
128     F3?   16 23 03
129    RTN          24
130    RCLE       36 15
131    GSBc   23 16 13
132    RTN          24
133   *LBLe   21 16 15
134    STOE       35 15
135     F1?   16 23 01
136    GTO1       22 01
137     F3?   16 23 03
138    RTN          24
139      1            01
140    RCLD       36 14
141    EEX          -23
142      2            02
143      ÷          -24
144    RCLA       36 11
145      ×          -35
146      3            03
147      6            06
148      8            08
149      ÷          -24
150      +          -55
151    EEX          -23
152      2            02
153    X≠Y          -41
154      ÷          -24
155   STOE       35 15
156    RTN          24
157   *LBL1   21 01
158    RCL7       36 07
159   STOE       35 15
160    RTN          24
161   *LBL2   21 02
162    RCLD       36 14
163    RTN          24
164    R/S          51
```

Calc. price given yield

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

LINEAR REGRESSION—EXPONENTIAL CURVE FIT

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

REGISTERS

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

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

```
113   ÷          -24
114   -          -45
115   ÷          -24
116   STOE    35 15
117   F0?  16 23 00
118   SPC     16-11
119   RCLD    36 14
120   GSB9    23 09
121   RCLC    36 13
122   GSB9    23 09
123   RCLE    36 15
124   P≠S     16-51
125   GSB9    23 09
126   RCLC    36 13
127   e^x        33
128   1          01
129   -          -45
130   EEX        -23
131   2          02
132   X          -35
133   GSB9    23 09
134   F0?  16 23 00
135   SPC     16-11
136   RTN        24
137   *LBLC      21 13
138   ISZI 16 26 46
139   RCLI    36 46
140   STO9    35 09
141   X≠Y        -41
142   STO0    35 00
143   X>0?    16-44
144   GTO0    22 00
145   SF1  16 21 01
146   GTO4    22 04
147   *LBLD      21 14
148   RCLB    36 12
149   X          -35
150   RCLA    36 11
151   +          -55
152   GTO9    22 09
153   *LBLE      21 15
154   RCLC    36 13
155   X          -35
156   e^x        33
157   RCLD    36 14
158   X          -35
159   GTO9    22 09
160   *LBL6 21 16 12
161   STO8    35 00
162   X≠Y        -41
163   STO9    35 09
164   X≠Y        -41
165   X>0?    16-44
166   GTO1    22 01
167   SF1  16 21 01
168   *LBL5      21 05
```

Display a (exp.)

Display b (exp.)

Display r^2 (exp.)

Continuous effective rate as a %.

Performs summations for trend line.

$\hat{y} = a + bx$

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

For deleting incorrect inputs.

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

Delete last trend value.

Print/pause flag.

Print command.

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

MULTIPLE LINEAR REGRESSION

```
001  *LBLA      21 11
002   CLRG      16-53
003   CF1    16 22 01
004   0            00
005   RTN          24
006  *LBLB      21 12
007   STOC      35 13
008   R↓          -31
009   STOB      35 12
010   R↓          -31
011   STOA      35 11
012   F0?    16 23 00
013   GSB8      23 08
014   7            07
015   STOI      35 46
016   R↓          -31
017   GSB1      23 01
018   8            08
019   STOI      35 46
020   RCLB      36 12
021   F0?    16 23 00
022   GSB6      23 06
023   GSB1      23 01
024   9            09
025   STOI      35 46
026   RCLC      36 13
027   F0?    16 23 00
028   GSB6      23 06
029   GSB1      23 01
030   RCLA      36 11
031   RCLB      36 12
032   x           -35
033   GSB2      23 02
034   ST+1   35-55 01
035   RCLA      36 11
036   RCLC      36 13
037   x           -35
038   GSB2      23 02
039   ST+2   35-55 02
040   RCLB      36 12
041   RCLC      36 13
042   x           -35
043   GSB2      23 02
044   ST+3   35-55 03
045   1            01
046   GSB2      23 02
047   ST+0   35-55 00
048   RCLB      36 00
049   F0?    16 23 00
050   GSB6      23 06
051   RTN          24
052  *LBL1      21 01
053   GSB2      23 02
054   ST+1   35-55 45
055   RCL1      36 46
056   3            03
```

Initialize

Input x_i, y_i, z_i

Compute Σx_i, Σy_i, Σz_i
Σx_i^2, Σy_i^2, Σz_i^2
$\Sigma x_i y_i$, $\Sigma y_i z_i$, $\Sigma z_i x_i$

Subroutine for Σx_i, ...
Σx_i^2, ...

```
057    -          -45
058   STO1      35 46
059   R↓          -31
060   X²           53
061   GSB2      23 02
062   ST+1   35-55 45
063   RTN          24
064  *LBLC      21 13
065   RCL0      36 00
066   RCL4      36 04
067   x           -35
068   RCL7      36 07
069   X²           53
070   -          -45
071   STOD      35 14
072   RCL0      36 00
073   RCL3      36 03
074   x           -35
075   RCL8      36 08
076   RCL9      36 09
077   x           -35
078   -          -45
079   x           -35
080   STOC      35 13
081   RCL0      36 00
082   RCL1      36 01
083   x           -35
084   RCL7      36 07
085   RCL8      36 08
086   x           -35
087   -          -45
088   STOA      35 11
089   RCL0      36 00
090   RCL2      36 02
091   x           -35
092   RCL7      36 07
093   RCL9      36 09
094   x           -35
095   -          -45
096   STOB      35 12
097   x           -35
098   RCLC      36 13
099   X≷Y         -41
100   -          -45
101   RCLD      36 14
102   RCL0      36 00
103   RCL5      36 05
104   x           -35
105   RCL8      36 08
106   X²           53
107   -          -45
108   x           -35
109   RCLA      36 11
110   X²           53
111   -          -45
112   ÷          -24
```

Calculate a, b, c

REGISTERS

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

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

```
113  STOC     35 13
114  RCLB     36 12
115  RCLA     36 11
116  RCLC     36 13
117    ×        -35
118    -        -45
119  RCLD     36 14
120    ÷        -24
121  STOB     35 12
122  RCL9     36 09
123  RCLC     36 13
124  RCL8     36 08
125    ×        -35
126    -        -45
127  RCLB     36 12
128  RCL7     36 07
129    ×        -35
130    -        -45
131  RCL6     36 06
132    ÷        -24
133  STOA     35 11
134  GSB7     23 07
135  RCLB     36 12
136  GSB9     23 09
137  RCLC     36 13
138  GTO9     22 09
139  *LBLD    21 14
140  RCLA     36 11
141  RCL9     36 09
142    x        -35
143  RCL5     36 12
144  RCL2     36 02
145    X        -35
146    +        -55
147  RCLC     36 13
148  RCL3     36 03
149    x        -35
150    +        -55
151  RCL5     36 09
152    Σ+       53
153  RCL6     36 06
154    ÷        -24
155    -        -45
156  RCLE     36 06
157  RCL9     36 09
158    Σ+       53
159  RCL0     36 00
160    ÷        -24
161    -        -45
162    ÷        -24
163  GTO7     22 07
164  *LBLE    21 15
165    XEY      -41
166    F0?   16 23 00
167  GSB8     23 08
168    XEY      -41
```

a

b

c

Calculate r^2

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

```
169  F0?   16 23 00
170  GSB6     23 06
171  RCLC     36 13
172    x        -35
173    XEY      -41
174  RCLB     36 12
175    x        -35
176    +        -55
177  RCLA     36 11
178    +        -55
179  GTO9     22 09
180  *LBLa    21 16 11
181    SF1   16 21 01
182  GSBB     23 12
183    CF1   16 22 01
184  RTN         24
185  *LBLe    21 16 15
186    F0?   16 23 00
187  GTO5     22 05
188  SF0   16 21 00
189    1           01
190  RTN         24
191  *LBL5       21 05
192    6           00
193  CF0   16 22 00
194  RTN         24
195  *LBL7       21 07
196  F0?   16 23 00
197  SPC      16-11
198  *LBL9       21 09
199  F09   16 23 00
200  GTO6        22 06
201  R/S         51
202  RTN         24
203  *LBL6       21 06
204  PRTX        -14
205  RTN         24
206  *LBL2       21 02
207  F1?   16 23 01
208  CHS         -22
209  RTN         24
210  *LBL8       21 08
211  SPC      16-11
212  GTO9        22 09
213  R/S         51
```

Correction of input values.

Print instructions

Change sign for correction.

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

TRIG: DEG ☒ GRAD ☐ RAD ☐

DISP: FIX ☒ SCI ☐ ENG ☐ n 2

BREAK-EVEN ANALYSIS

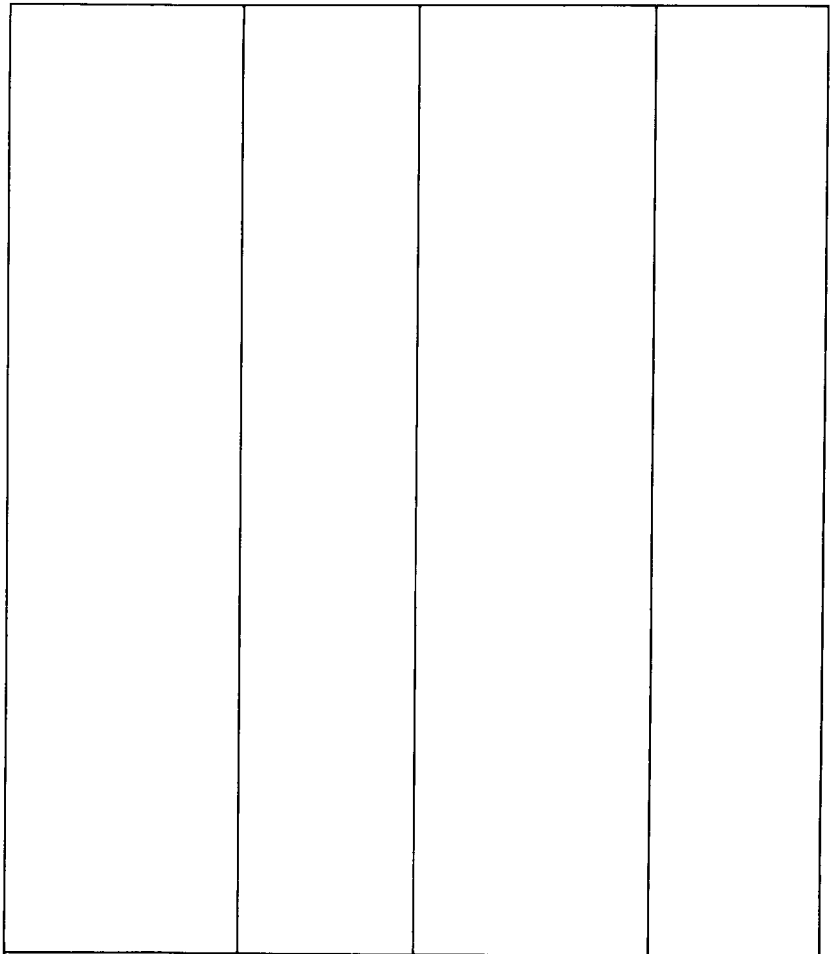
```
001  *LBLA      21 11
002   STOA      35 11   F→RA
003   F3?  16 23 03   Digit entered?
004   RTN         24
005   RCLB      36 12
006   RCLC      36 13
007   -          -45   Calculate F and store in
008   RCLD      36 14   RA.
009   x          -35
010   RCLE      36 15
011   -          -45
012   STOA      35 11
013   RTN         24
014  *LBLB      21 12   ----------
015   STOB      35 12   P→RB
016   F3?  16 23 03
017   RTN         24   Digit entered?
018   RCLA      36 11
019   RCLE      36 15
020   +          -55   Calculate P and store in
021   RCLD      36 14   RB.
022   ÷          -24
023   RCLC      36 13
024   +          -55
025   STOB      35 12
026   RTN         24
027  *LBLC      21 13   ----------
028   STOC      35 13   V→RC
029   F3?  16 23 03   Digit entered?
030   RTN         24
031   RCLB      36 12
032   RCLA      36 11   Calculate V and store in RC.
033   RCLE      36 15
034   +          -55
035   RCLD      36 14
036   ÷          -24
037   -          -45
038   STOC      35 13
039   RTN         24
040  *LBLD      21 14   ----------
041   STOD      35 14   U→RD
042   F3?  16 23 03   Digit entered?
043   RTN         24
044   RCLA      36 11
045   RCLE      36 15   Calculate U and store in
046   +          -55   RD.
047   RCLB      36 12
048   RCLC      36 13
049   -          -45
050   ÷          -24
051   STOD      35 14
052   RTN         24   ----------
053  *LBLE      21 15   GP→RE
054   STOE      35 15
055   F3?  16 23 03   Digit entered?
056   RTN         24

057   RCLB      36 12
058   RCLC      36 13   Calculate GP and store
059   -          -45   in RE.
060   RCLD      36 14
061   x          -35
062   RCLA      36 11
063   -          -45
064   STOE      35 15
065   RTN         24
066  *LBLa      21 16 11   ----------
067   RCLB      36 12
068   RCLC      36 13   Calculate OL
069   -          -45
070   RCLD      36 14
071   x          -35
072   STOI      35 46
073   RCLI      36 46
074   RCLA      36 11
075   -          -45
076   ÷          -24
077   RTN         24
078   R/S         51
```

REGISTERS

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

A	B	C	D	E	I
F	P	V	U	GP	P(U − V)



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

FLAGS
0
1
2
3 Digit?

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

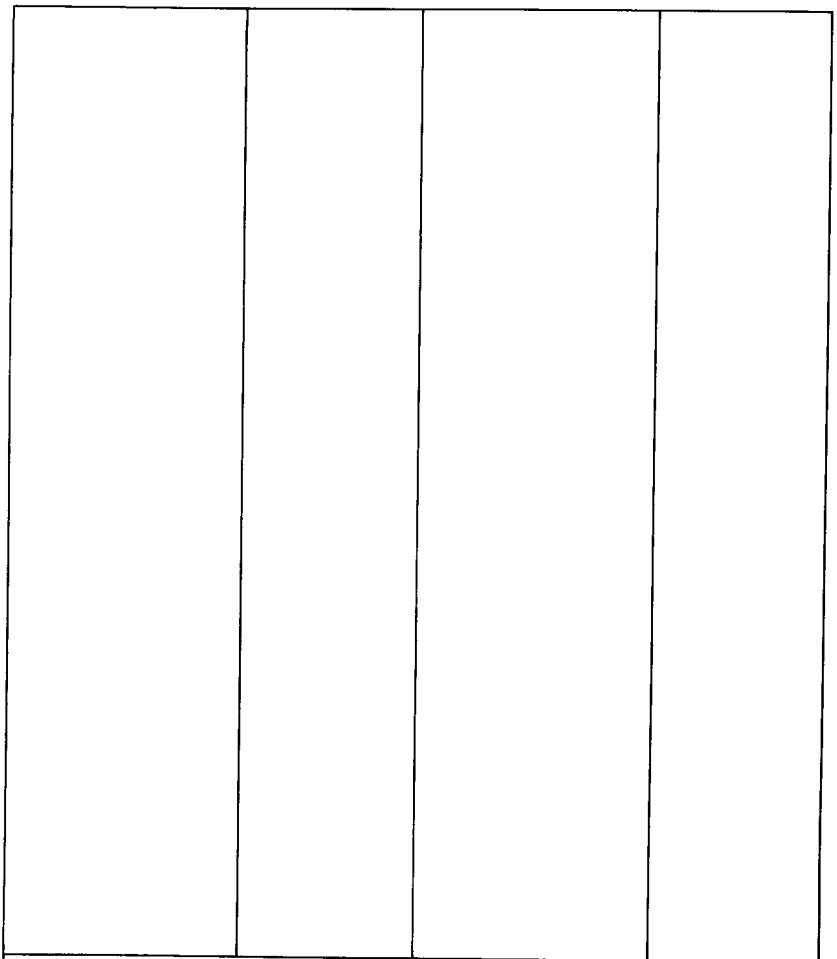
INVOICING

```
001  *LBLA      21 11
002   CLRG      16-53   Clear registers and
003   P≠S       16-51   initialize R1
004   CLRG      16-53
005     2         02
006   STO1      35 46
007     0         00
008   RTN         24
009  *LBLB      21 12   DISC→RE
010   STOE      35 15
011   RTN         24
012  *LBLC      21 13   UNITS→RD
013   STOD      35 14
014   RTN         24
015  *LBLD      21 14   PRICE→RC
016   STOC      35 13
017   RTN         24
018  *LBLE      21 15
019   GSB5      23 05   Net line total→Ri
020   STOi      35 45
021   ST+0   35-55 00
022   ST+1   35-55 01
023   ISZI   16 26 46   Check to see if number of
024     2         02    inputs is ≤ 22. If not, show
025     2         02    ERROR.
026   RCLI      36 46
027   X>Y?      16-34
028   GTO9      22 09
029   R↓          -31
030   R↓          -31
031   RTN         24
032  *LBL5      21 05
033   RCLC      36 13   Net line total calculated.
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  *LBLa   21 16 11   Display subtotal and clear
046   RCL0      36 00   register.
047   ENT↑        -21
048   CLX         -51
049   STO0      35 00
050   X≷Y         -41
051   GSB2      23 02
052   RTN         24
053  *LBLb   21 16 12   Recall Grand Total
054   RCL1      36 01
055   GSB2      23 02
056   RTN         24

057  *LBLc   21 16 13
058     2         02   Recall and display line
059   STO1      35 46   total as % of Grand Total.
060  *LBL1      21 01
061   RCLi      36 45
062   X=0?      16-43
063   GTO4      22 04
064   RCL1      36 01   Check to recall only those
065     ÷         -24   registers containing line
066   EEX         -23   totals.
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   GTO1      22 01
076  *LBL4      21 04   Last output is 100 – you
077     1         01    are done!
078     0         00
079     0         00
080   GSB2      23 02
081   RTN         24
082  *LBL2      21 02   Test print/pause flag.
083   F0?   16 23 00
084   GTO3      22 03
085   R/S         51
086   RTN         24
087  *LBL3      21 03   Print/pause
088   PRTX        -14
089   RTN         24
090  *LBLe   21 16 15
091   F0?   16 23 00   Print/pause flag set and
092   GTO0      22 00   unset.
093   SF0   16 21 00
094     1         01
095   RTN         24
096  *LBL0      21 00
097   CF0   16 22 00
098     0         00
099   RTN         24
100  *LBLd   21 16 14   Routine to delete
101   DSZI   16 25 46   incorrect line totals.
102     0         00
103   STO1      35 45
104   GSB5      23 05
105   ST-0   35-45 00
106   ST-1   35-45 01
107   RCL0      36 00
108   R/S         51
```

REGISTERS

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



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

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

PAYROLL

001	*LBLA	21 11	Read data card. If data card
002	0	00	read, go to c. Otherwise
003	PSE	16 51	repeat sequence.
004	F3?	16 23 03	
005	GTOc	22 16 13	
006	GTOA	22 11	----------
007	*LBLc	21 16 13	Display SS No.
008	RCL1	36 46	
009	GSB9	23 09	Display marital status.
010	RCLE	36 15	
011	GSB9	23 09	
012	RCLB	36 12	Display number of
013	GSB9	23 09	exemptions.
014	RTN	24	----------
015	*LBLB	21 12	
016	RCLC	36 13	#hrs x hrly wage
017	x	-35	
018	RND	16 24	
019	STO1	35 01	
020	STO9	35 09	
021	ST+0	35-55 00	
022	GSB9	23 09	
023	RTN	24	----------
024	*LBLC	21 13	#hrs x OT wage
025	RCLD	36 14	
026	x	-35	
027	RND	16 24	
028	ST+0	35-55 00	
029	ST+1	35-55 01	
030	ST+9	35-55 09	
031	RCL9	36 09	
032	GSB9	23 09	
033	RTN	24	----------
034	*LBL0	21 14	Fed'l. tax
035	STO2	35 02	Tot. Fed'l. tax
036	ST+3	35-55 03	Net pay – Fed'l. tax
037	ST-9	35-45 09	
038	RCL2	36 02	Display Fed'l. tax
039	GSB9	23 09	
040	RTN	24	
041	*LBLE	21 15	----------
042	STO2	35 02	State tax
043	ST+4	35-55 04	Tot. State tax
044	ST-9	35-45 09	Net pay-State tax
045	RCL2	36 02	
046	GSB9	23 09	Display State tax
047	RTN	24	----------
048	*LBLa	21 16 11	
049	1	01	FICA tax base
050	5	05	
051	3	03	
052	0	00	
053	0	00	
054	RCL0	36 00	Gross > 15300?
055	X>Y?	16-34	
056	GTO0	22 0.	

057	RCL1	36 01	
058	*LBL3	21 03	(Wage) 5.85%
059	5	05	
060	.	-62	
061	8	08	
062	5	05	
063	%	55	
064	RND	16 24	
065	ST+5	35-55 05	Σ FICA
066	ST-9	35-45 09	Net pay-FICA
067	GSB9	23 09	----------
068	*LBL2	21 02	California SDI tax base
069	9	09	
070	EEX	-23	
071	3	03	
072	RCL0	36 00	
073	X>Y?	16-34	Gross > 9000?
074	GTO6	22 06	
075	RCL1	36 01	
076	*LBL4	21 04	(Wage) 1%
077	1	01	
078	%	55	
079	RND	16 24	
080	ST+6	35-55 06	Σ SDI
081	ST-9	35-45 09	
082	GSB9	23 09	Net pay – SDI
083	*LBL5	21 05	----------
084	RCL7	36 07	Net pay – Const. 1
085	ST-9	35-45 09	
086	GSB9	23 09	
087	RCL1	36 01	Net Pay – Wage x Const. 2
088	RCL8	36 08	
089	%	55	
090	RND	16 24	
091	ST-9	35-45 09	
092	GSB9	23 09	Net pay – Const. 3
093	RCLA	36 11	
094	ST-9	35-45 09	
095	GSB9	23 09	Net pay
096	RCL9	36 09	Write new data
097	NDTA	16-61	
098	CF3	16 22 03	
099	GSB9	23 09	
100	RTN	24	DONE!
101	*LBL6	21 06	----------
102	X≠Y	-41	Gross – 15300
103	-	-45	
104	RCL1	36 01	Wage > Gross – 15300?
105	X>Y?	16-34	
106	GTO1	22 01	No more FICA to with-
107	0	00	hold; continue.
108	GSB9	23 09	
109	GTO2	22 02	----------
110	*LBL1	21 01	Amount to apply to FICA
111	X≠Y	-41	tax is
112	-	-45	wage – (Gross – 15300)

REGISTERS

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

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

113	GTO3	22 03	
114	*LBL6	21 06	
115	X≷Y	-41	Gross−9000
116	-	-45	
117	RCL1	36 01	Wage > Gross−9000?
118	X>Y?	16-34	
119	GTO7	22 07	No more SDI to withhold;
120	0	00	continue.
121	GSB9	23 09	
122	GTO5	22 05	- - - - - - - - - - - -
123	*LBL7	21 07	Amount to apply to SDI
124	X≷Y	-41	tax is Wage−(Gross−9000)
125	-	-45	
126	GTO4	22 04	
127	*LBLe	21 16 15	- - - - - - - - - - - -
128	F0?	16 23 00	Set and unset print/pause
129	GTO1	22 01	flag.
130	SF0	16 21 00	
131	1	01	
132	RTN	24	
133	*LBL1	21 01	- - - - - - - - - - - -
134	CF0	16 22 00	
135	0	00	Print command
136	RTN	24	
137	*LBL9	21 09	
138	F0?	16 23 00	
139	GTO8	22 08	
140	R/S	51	
141	RTN	24	
142	*LBL8	21 08	
143	PRTX	-14	
144	RTN	24	
145	*LBLb	21 16 12	- - - - - - - - - - - -
146	RCL0	36 00	Gross
147	GSB9	23 09	
148	RCL3	36 03	Total Fed'l.
149	GSB9	23 09	
150	RCL4	36 04	Total State
151	GSB9	23 09	
152	RCL5	36 05	Total FICA
153	GSB9	23 09	
154	RCL6	36 06	Total SDI
155	GSB9	23 09	
156	RTN	24	
157	R/S	51	

LABELS

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

FLAGS

SET STATUS

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

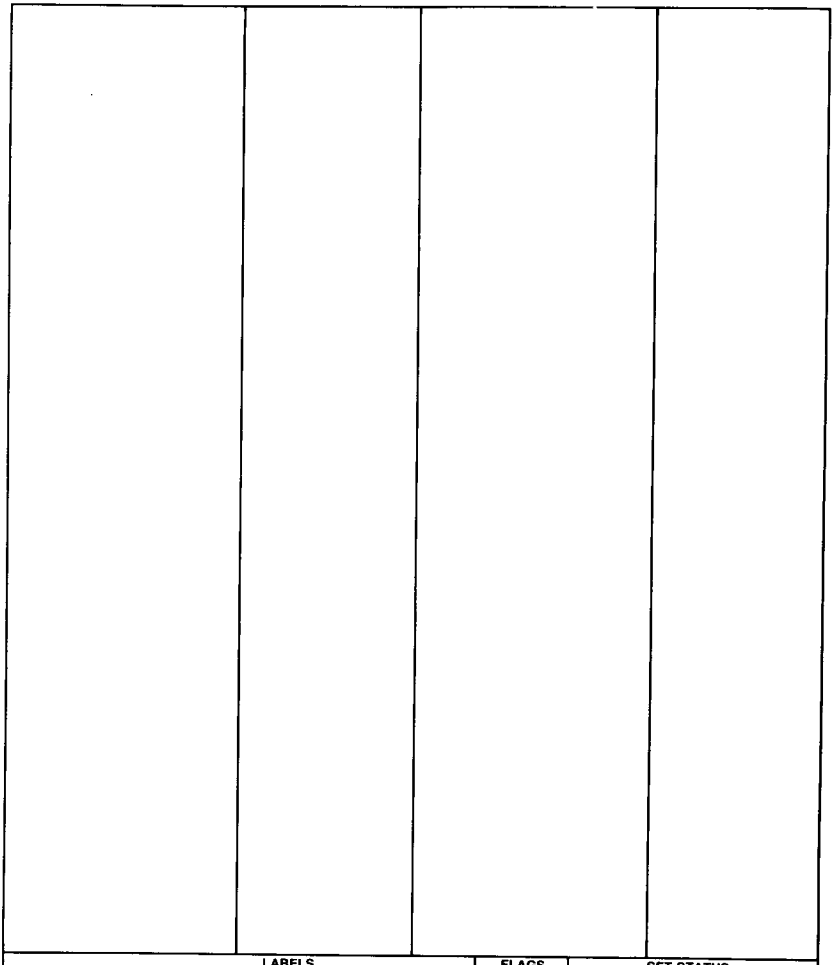
INVENTORY

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

REGISTERS

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

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



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

Appendix A

MAGNETIC CARD SYMBOLS AND CONVENTIONS

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

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

Appendix B
PRINCIPAL EQUATIONS

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

Program Number

1. Internal Rate of Return

Solve for IRR in:

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

where:

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

2. Internal Rate of Return—Groups

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

$$n_0 = 0$$

where:

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

3. Discounted Cash Flow Analysis—Net Present Value

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

where:

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

4. Direct Reduction Loans—Sinking Fund

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

5. Accumulated Interest/Remaining Balance

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

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

where:

k^{th} payment to principal = $BAL_{K-1} - BAL_K$
k^{th} payment to interest = $PMT - (BAL_{K-1} - BAL_K)$
Total payment to interest = $(K) \times (PMT) - (PV - BAL_K)$

6. Wrap-Around Mortgage

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

7. Constant Payment to Principal Loan Amortization Schedule

where:

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

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

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

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

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

$$APR = 12i$$

where:

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

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

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

9. Savings Plan—Leases

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

10. Advance Payments

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

11. Savings—Compounding Periods Different from Payment Periods

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

when $P/C \leq 1$

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

$$Z = (1 + Q)$$

$$n = \#PAY$$

when P/C > 1

$$Q = i$$

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

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

12. Simple Interest/Interest Conversions

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

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

finite compounding

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

continuous compounding

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

13. Depreciation Schedules

where:

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

Straight Line Schedule

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

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

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

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

$$RBV_K = RDV_K + SAL$$

Sum-of-the-Years'-Digits Schedule

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

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

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

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

$$RBV_K = RDV_K + SAL$$

Variable Rate Declining Balance Schedule

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

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

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

$$RBV_K = RDV_K + SAL$$

Crossover Point—Declining Balance to Straight Line

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

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

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

14. Days Between Dates

Actual

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

where

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

and

for $mm \leq 2$

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

for $mm > 2$

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

30/360 Basis

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

for f(DT1)

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

for f (DT2)

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

15. Bond Price and Yield

for PER > 1

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

where

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

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

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

for PER < 1

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

16. Interest at Maturity/Discounted Securities

Price (given yield) =

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

Yield (given price) =

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

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

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

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

17. Linear Regression

for

$$y = a + bx$$

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

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

where:

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

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

n = number of data pairs

Exponential Curve Fit

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

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

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

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

n = number of data pairs

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

18. Multiple Linear Regression

$$z = a + bx + cy$$

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

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

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

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

where:

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

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

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

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

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

19. Break Even Analysis

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

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

20. Invoicing

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

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