## HEWLETT PACKARD

## HP:65 <br> FINANCE PAC 1

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## INTRODUCTION

Your HP-65 Finance Pac I contains 38 programs on 40 magnetic cards that address frequently encountered problems in many areas of personal and business finance. Calculations for loans, savings, annuities, investment analysis, depreciation, business statistics, leases, and other applications are included.

An important design criterion for these programs was the requirement that they should not simply solve important problems but should also be easy to use in the business environment. Our pleasant experiences with the HP-80 and HP-81 business/finance calculators contributed many useful features in this respect. Data can generally be entered in any sequence and data reentry requirements have been minimized so that, when evaluating alternatives, only values that change need to be keyed in for each new case. Industry conventions were observed, and programs with a common thread operate similarly. The result of these efforts is that you can quickly begin to use your HP-65 to assist in making financial decisions after learning only a few fundamentals, such as how to enter a prerecorded program.

The programs are fully documented for the bulk of envisioned usage in the section titled Program Instructions. Here there are diagrams, descriptions, operating instructions, and one or more sample problems with solutions for each program. Additional important, but less frequently referenced, material is presented in the Appendices. An easily accessed summary of principal label conventions is available immediately after the Table of Contents.

To acquaint yourself with Finance Pac I we suggest that you first turn to the program instructions of a program that interests you, select the appropriate magnetic card and try the sample problems shown. Next, familiarize yourself with the information available in the Appendices, and then try a few of your "real world" problems.

We hope you find the HP-65 Finance Pac 1 a useful tool, and welcome your comments, requests, and suggestions-these are our most important source of future user-oriented programs.

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## LABEL CONVENTIONS, PROGRAMS 1 THROUGH 17

The labels and associated information summarized in the table below apply to programs 1 through 17. Additional information appears in the individual program instructions and in Appendix D.
LABEL KEY INPUT/OUTPUT VALUE REGISTER

| n | A | total number of periods | 1 |
| :---: | :--- | :--- | :--- |
| i | B | periodic interest rate expressed <br> as a percent. | 2 |
| PMT | Cperiodic payment amount; may <br> occur at the beginning or end <br> of payment periods depending <br> on the problem. | 3 |  |

PV D present value occurring at the ..... 4
beginning of first period.
FV** E future value occurring at the end ..... 5 of the last period.
BAL** E balloon payment amount or ..... 5remaining balance occurringat the end of the last period.
*The periodic interest rate is stored as a decimal value.
**FV and BAL never appear in the same program.

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## COMPOUND AMOUNT



PV

## Description:

Given values for any three of the four variables ( $\mathrm{n}, \mathrm{i}(\%)$, PV or FV) COMPOUND AMOUNT will calculate a value for the remaining variable.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in 3 of the following: |  |  |  |  |
|  | - number of compounding |  |  |  |  |
|  | periods | n | A |  | 0.00 |
|  | - periodic interest rate | i (\%) | B |  | 0.00 |
|  | - present value | PV | D |  | 0.00 |
|  | - future value | FV | E |  | 0.00 |
| 3 | Calculate the remaining variable: |  |  |  |  |
|  | - number of compounding |  |  |  |  |
|  | periods |  | A |  | n |
|  | - periodic interest rate |  | B |  | i (\%) |
|  | - present value, |  | D |  | PV |
|  | - future value |  | E |  | FV |
| 4 | For a new case go to step 2 and |  |  |  |  |
|  | change the appropriate values. |  |  |  |  |

## Examples

## Problem Statement:

If $\$ 155$ is placed in a savings account paying $53 / 4 \%$ compounded monthly, what sum of money will be in the account at the end of 9 years?

| Keystrokes | See Displayed |
| :---: | :---: |
| 155 D | 0.00 |
| 5.75 ENTERA $12 \div$ B | 0.00 |
| 9 ENTER4 12 $\boldsymbol{X}$ A | 0.00 |
| E | 259.74 |

Problem Statement:
Assume that the previous calculation has just been performed as shown. Determine the sum that will be in the account at the end of 5 years, if all other values are unchanged.


## Problem Statement:

A house purchased 11 years ago for $\$ 25,000$ is now worth $\$ 22,000$. What annual appreciation/depreciation rate does this represent?

| Keystrokes | See Displayed |
| :--- | :--- |
| $11 \mathrm{~A} \longrightarrow$ |  |
| $25000 \mathrm{D} \longrightarrow 0.00$ |  |
| $22000 \mathrm{E} \longrightarrow$ |  |
| $\mathbf{B} \longrightarrow$ |  |
|  | 0.00 |
| (annual depreciation rate of $1.16 \%$ ) |  |

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> DIRECT REDUCTION LOAN SOLVE FOR n, PMT, OR PV


Description:
Given the periodic interest rate (i) and values for two other variables ( n , PMT, or PV) this program will calculate a value for the remaining variable.


## Examples

## Problem Statement:

What is the monthly payment required to fully amortize a 30 year, $\$ 30,000$ mortgage if the annual percentage rate is $9 \%$ ?
Keystrokes


C
241.39

## Problem Statement:

Having just performed the previous calculation the realtor is delighted since his client feels he can afford $\$ 250$ per month. Without changing the term or interest rate the agent would like to determine the largest loan amount that this payment would amortize.

| Keystrokes | See Displayed |
| :--- | :--- |
| $250 \mathrm{C} \longrightarrow$ | 0.00 |
| $\mathrm{D} \longrightarrow$ | 31070.47 |

## Problem Statement:

Roy Martin is considering a junior mortgage that has 60 remaining monthly payments of $\$ 148.73$. How much should Roy pay for this "second" mortgage if he requires a $12.5 \%$ annual yield rate and assuming the mortgage is not prepaid?

Keystrokes
See Displayed
60 A 148.73 C 12.5 ENTER $12\left[\begin{array}{l}\circ \\ \div \\ \text { B } \\ \text { D } \longrightarrow 610.83\end{array}\right.$

## Problem Statement:

Intending to establish a fixed term annuity for himself, Dennis York placed $\$ 25,000$ in a savings account paying $5 \%$ compounded quarterly. At the end of each quarter he will be withdrawing $\$ 1200$. How many withdrawals will Dennis be able to make?


# DIRECT REDUCTION LOAN SOLVE FOR i 



## Description:

This program calculates the periodic interest rate (i) given values for the other three variables (n, PMT, PV).
(See Appendix E for comments on iterative solutions.)

| STEP | INSTRUCTIONS | INPUT DATA/UNITS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |
| 2 | Key in all of the following: |  |  |  |
|  | - number of payment periods | n | A |  |
|  | - periodic payment amount | PMT | C |  |
|  | - loan amount (present value) | PV | D |  |
| 3 | Calculate periodic interest rate |  | B | i (\%) |
| 4 | For a new case go to step 2 |  |  |  |
|  | and change the appropriate |  |  |  |
|  | values |  |  |  |

## Examples

## Problem Statement:

Maureen Paris has a $\$ 56,000$ loan requiring 300 monthly payments of $\$ 432.22$. What annual interest rate does this represent?

| Keystrokes | See Displayed |
| :---: | :---: |
| 56000 D 300 A 432.22 C B $\longrightarrow 0.67$ |  |
|  | (.67\% is the monthly interest rate) |
| $12 \mathrm{x} \longrightarrow \mathrm{L}$ (8\% annual interest rate) |  |
|  |  |

## Problem Statement:

A mortgage with quarterly payments of $\$ 2,115.21$ will be fully amortized in 12 years. If the mortgage can be purchased for $\$ 56,000$ and the loan is not prepaid, what annual yield rate does this investment opportunity represent?


## Problem Statement:

A fixed term annuity is available which requires a $\$ 35,000$ initial deposit. In return the depositor will receive monthly payments of $\$ 231$ for 20 years. What annual interest rate is being applied?


# DIRECT REDUCTION LOAN <br> WITH BALLOON PAYMENT SOLVE FOR n, PMT, PV, OR BAL 



## Description:

Given the periodic interest rate (i) and values for three other variables ( $\mathrm{n}, \mathrm{PMT}$, PV or BAL) this program will calculate a value for the remaining variable.

When entering the periodic interest rate with the B key an intermediate calculation may cause a display of all 9's instead of zero. No damage has been done however. Simply press CLX and continue operations.


## Examples

## Problem Statement:

Two individuals are constructing a loan with a balloon payment. The loan amount is $\$ 3,600$ and it is agreed that the annual interest rate will be $10 \%$ with 36 monthly payments of $\$ 100$. What balloon payment amount, to be paid coincident with the 36th payment, is required to fulfill the loan agreement?

| Keystrokes | See Displayed |
| :---: | :---: |
| 3600 D 10 | 675.27 |

## Problem Statement:

A company intends to pay off its $6 \%$ long term loan of $\$ 1,000,000$ and semi-annual payments of $\$ 68,000$ when the remaining balance is $\$ 500,000$. When will the remaining balance be this amount?

Keystrokes See Displayed


## Problem Statement:

An investor is considering buying an $8 \%, \$ 52,000$ mortgage. Monthly payments are $\$ 402$, and it is assumed that this mortgage will be prepaid in 11 years. What should the investor pay for this mortgage if he requires a $10 \%$ yield on his investments?

| Keystrokes | See Displayed |
| :---: | :---: |
| 8 ENTER 12 - B 52000 D $402 \mathrm{C} \longrightarrow 0.00$ |  |
| 11 ENTER4 $12 \times \mathrm{A} \boldsymbol{\mathrm { E }} \longrightarrow 40347.88$ |  |

(This is the remaining balance at the end of 11 years)

10 ENTER4 $12 \square 45600.94$
(He should pay $\$ 45,600.94$ to achieve a yield of $10 \%$ )

# DIRECT REDUCTION LOAN <br> WITH BALLOON PAYMENT SOLVE FOR i 



## Description:

This program will calculate the periodic interest rate (i) given values for the other four variables ( $\mathrm{n}, \mathrm{PMT}, \mathrm{PV}$, and BAL)
(See Appendix E for comments on iterative solutions.)

| STEP | $\begin{array}{c}\text { INSTRUCTIONS }\end{array}$ | $\begin{array}{c}\text { INPUT } \\ \text { DATA/UNITS }\end{array}$ | KEYS |
| :---: | :--- | :---: | ---: | ---: | :--- |
| DATA/UNITS |  |  |  |$)$

## Examples

## Problem Statement:

Find the annual interest rate on a $\$ 2,100$ loan requiring 24 monthly payments of $\$ 42.52$ and a balloon payment of $\$ 1,500$ due coincident with the 24th payment.

| Keystrokes | See Displayed |
| :---: | :---: |
| 2100 D 24 A 42.52 C 1500 E B $\longrightarrow 0.96$ |  |
|  | ly interest rate) |

## $12 \times$ <br> 11.53

(11.53\% annual interest rate)

## Problem Statement:

Assume that the above calculation has just been performed, and it is discovered that the balloon payment of $\$ 1,500$ occurs one month after the last monthly payment (i.e., end of month 25 ). What is the annual interest rate if all other values remain the same?


## Notes:

(1) This program assumes that there are $n$ equal payments with a BAL payment coincident with the last payment. Therefore, to accommodate the above example, and without changing the actual problem, the data was restructured to "look like" 25 equal payments of 42.52 and a balloon payment of 1457.48.
(2) The balloon payment of $\$ 1500$ could have been recalled from register 5 , and the periodic payment of 42.52 could have been recalled from register 3.

## Problem Statement:

A piece of income property can be purchased for an equity investment of $\$ 200,000$ and a mortgage on the remainder. It is estimated that this investment will generate an annual net cash flow (after operating expenses and debt service) of $\$ 12,000$. The property will be sold after 6 years, and the net proceeds from the sale are projected to be $\$ 300,000$. What is the projected annual yield or rate of return for this investment?

## SINKING FUND SOLVE FOR n, PMT OR FV



## Description:

Given the periodic interest rate (i) and values for two other variables ( n , PMT, or FV) this program will calculate a value for the remaining variable.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in |  |  |  |  |
|  | - periodic interest rate | i (\%) | B |  | 0.00 |
|  | and two of the following: |  |  |  |  |
|  | - number of payment periods | n | A |  | 0.00 |
|  | - periodic payment amount | PMT | C |  | 0.00 |
|  | - future value | FV | E |  | 0.00 |
| 3 | Calculate the remaining |  |  |  |  |
|  | variable: |  |  |  |  |
|  | - number of payment periods |  | A |  | n |
|  | - periodic payment amount |  | C |  | PMT |
|  | - future value |  | E |  | FV |
| 4 | For a new case go to step 2 |  |  |  |  |
|  | and change the appropriate |  |  |  |  |
|  | values |  |  |  |  |

## Examples

## Problem Statement:

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

See Displayed

## 50000 E 3 ENTERA 4 X A

7 ENTER4 $4 \div$ B $\mathbf{-}$
3780.69

## Problem Statement:

Implementation of a new process will save a company $\$ 12,000$ a year in manufacturing costs for a product that will continue to be manufactured for about 5 years. If the company uses $6 \%$ as the "cost of capital" what will be the value of these savings at the end of the product's life?

| Keystrokes |  |
| :--- | :--- |
| 12000 C 5 A 6 B | S $\longrightarrow$ |
|  | See Displayed |
| 67645.12 |  |

(future value of the savings will be $\$ 67,645.12$ )

## Note:

Program 2 could be used to determine the present value of these savings.

## SINKING FUND <br> SOLVE FOR i



## Description:

This program will calculate the periodic interest rate (i) given values for the other three variables ( $\mathrm{n}, \mathrm{PMT}$, and FV).
(See Appendix E for comments on iterative solutions.)

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in all of the following |  |  |  |  |
|  | - number of payment periods | n | A |  |  |
|  | - periodic payment amount | PMT | C |  |  |
|  | - future value | FV | E |  |  |
| 3 | Calculate periodic interest rate |  | B |  | i (\%) |
| 4 | For a new case go to step 2 and |  |  |  |  |
|  | change the appropriate values |  |  |  |  |

## Example

## Problem Statement:

Participation in a fund is being offered, whereby the investor is required to pay $\$ 180$ at the end of the first month and every month thereafter for 15 years. At the end of that time he will receive a lump sum payment of $\$ 45,000$. What annual interest rate will the investor realize from this fund?

Keystrokes See Displayed
180 C 15 ENTER4 $12 \boldsymbol{x}$ A 45000 E B $\longrightarrow .35$
(.35\% monthly rate)
$12 \times$ 4.19
(an annual interest rate of 4.19\%)

## PERIODIC SAVINGS, ANNUITY DUE SOLVE FOR n, PMT OR FV



## Description:

Given the periodic interest rate (i) and values for two other variables ( n , PMT, or FV) this program will calculate a value for the remaining variable.


## Examples

## Problem Statement:

Mr. Columbus has his eye on a sail boat costing $\$ 5,650$. Starting now he intends to deposit $\$ 120$ per month in a savings account paying $51 / 2 \%$ compounded monthly. How long will it take him to accumulate the price of the boat?

```
Keystrokes See Displayed
5650 E 120 C 5.5 ENTER4 12 O B A C O C [ 42.55
                                    (almost 43 months)
12%\longrightarrow}3.5
```


## Problem Statement:

It has been determined that $\$ 15,000$ will be required to send a son to college 13 years from now. A savings plan paying $7 \%$ compounded quarterly is available. If deposits start at the beginning of the next quarter what equal quarterly payments should be made in order to accrue the desired amount?

Keystrokes
See Displayed
15000 E 13 ENTER44 $\mathbf{x} A$
7 ENTER4 $4 \div 176.12$

## Problem Statement:

Having just performed the above calculation the parent would like to calculate the sum that would be accumulated if the quarterly payments were increased to $\$ 180$.

| Keystrokes |  |
| :--- | :--- |
| 180 CE $\longrightarrow$ | See Displayed |
|  | 15330.66 |

## PERIODIC SAVINGS, ANNUITY DUE SOLVE FOR i



## Description:

This program calculates the periodic interest rate (i) given values for the other three variables ( $\mathrm{n}, \mathrm{PMT}$, and FV).
(See Appendix E for comments on iterative solutions.)

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in all of the following: |  |  |  |  |
|  | - number of payment periods | n | A |  |  |
|  | - periodic payment amount | PMT | C |  |  |
|  | - future value | FV | E |  |  |
| 3 | Calculate the periodic interest |  |  |  |  |
|  | rate |  | B |  | i (\%) |
| 4 | For a new case go to step 2 |  |  |  |  |
|  | and change the appropriate |  |  |  |  |
|  | values |  |  |  |  |

## Examples

## Problem Statement:

An individual planning future needs has determined that he will require $\$ 10,000$ in 15 years. All he feels he can afford towards this goal is $\$ 25$ per month. What annual interest rate must a savings or investment plan offer if he is to achieve this goal?


## PRESENT VALUE, ANNUITY DUE SOLVE FOR n, PMT, OR FV



## Description:

Given the periodic interest rate (i) and values for two other variables ( n , PMT, or PV) this program will calculate a value for the remaining variable.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in |  |  |  |  |
|  | - periodic interest rate | i (\%) | B |  | 0.00 |
|  | and two of the following: |  |  |  |  |
|  | - number of periodic pay- |  |  |  |  |
|  | ments | n | A |  | 0.00 |
|  | - periodic payment amount | PMT | C |  | 0.00 |
|  | - present value | PV | D |  | 0.00 |
| 3 | Calculate the remaining |  |  |  |  |
|  | variable: |  |  |  |  |
|  | - number of periodic pay- |  |  |  |  |
|  | ments |  | A |  | n |
|  | - periodic payment amount |  | C |  | PMT |
|  | - present value |  | D |  | PV |
| 4 | For a new case go to step 2 |  |  |  |  |
|  | and change the appropriate |  |  |  |  |
|  | variables |  |  |  |  |

## Examples

## Problem Statement:

The owner of a piece of equipment presently worth $\$ 70,000$ intends to lease the equipment for 5 years. He estimates that the equipment will have no residual (salvage) value at the end of the lease and he desires a $7 \%$ annual yield. What should he establish as the quarterly payment assuming payments are made at the beginning of each quarter?

## Keystrokes

See Displayed
70000 D 5 ENTER4 4 区 A
7 ENTER $44 \div$ B C $\longrightarrow 4106.52$

## Problem Statement:

The owner in the previous problem has reason to believe that his prospective customer would prefer a lower payment and a longer term. What is the payment if the lease is for a 6 year period?

```KeystrokesSee Displayed6 ENTER 4 区 A C3535.13
```


## Problem Statement:

A firm can purchase a piece of equipment from Company Z for $\$ 30,000$. Alternatively the company can acquire the equivalent machinery from Company Y with a conditional sales contract requiring 8 semi-annual payments of $\$ 4,200$. The first payment is due when the contract is signed. If the firm uses a $9 \%$ "cost of capital" assumption, which alternative is least expensive?

| Keystrokes |  |
| :--- | :--- |
| 8 A 4200 C 9 9 ENTER4 2 - | B D $\longrightarrow$ | See Displayed

The present value of Company Y's offer is $\$ 28,949.34$ and this is less expensive than Company Z's purchase price.

## PRESENT VALUE, ANNUITY DUE SOLVE FOR $\mathbf{i}$



## Description:

This program will calculate the periodic interest rate (i) given values for the other three variables ( $\mathrm{n}, \mathrm{PMT}$, and PV).
(See Appendix E for comments on iterative solutions.)

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in all of the following: |  |  |  |  |
|  | - number of payment periods | n | A |  |  |
|  | - periodic payment amount | PMT | C |  |  |
|  | - present value | PV | D |  |  |
| 3 | Calculate the periodic interest |  |  |  |  |
|  | rate |  | B |  | i (\%) |
| 4 | For a new case go to step 2 |  |  |  |  |
|  | and change the appropriate |  |  |  |  |
|  | values |  |  |  |  |

## Example

## Problem Statement:

Competitive conditions suggest that $\$ 340$ per month is the most a manufacturer could expect the market to bear on a standard 4 year lease for a particular product. If the total cost to produce and sell the product is $\$ 13,000$ what will the annual yield rate be under these conditions? (The product will have no residual value at the end of the lease.)
Keystrokes See Displayed
(1.01\% monthly yield)

12 区
12.17\%
(an annual yield of $12.17 \%$ )

## PRESENT VALUE ANNUITY DUE, WITH BALLOON PAYMENT SOLVE FOR n, PMT, PV, OR BAL



Description:
Given the periodic interest rate (i) and values for three other variables ( $\mathrm{n}, \mathrm{PMT}, \mathrm{PV}$, or BAL) this program will calculate a value for the remaining variable.

When entering the periodic interest rate with the B key an intermediate calculation may cause a display of all 9's instead of zero. No damage has been done however. Simply press CLX and continue operations.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in |  |  |  |  |
|  | - periodic interest rate | i (\%) | B |  | 0.00 |
|  | and three of the following: |  |  |  |  |
|  | - number of payment periods | n | A |  | 0.00 |
|  | - periodic payment amount | PMT | C |  | 0.00 |
|  | - present value | PV | D |  | 0.00 |
|  | - balloon payment at the end |  |  |  |  |
|  | of period n | BAL | E |  | 0.00 |
| 3 | Calculate the remaining variable |  |  |  |  |
|  | - number of payment periods |  | A |  | n |
|  | - periodic payment amount |  | C |  | PMT |
|  | - present value |  | D |  | PV |
|  | - balloon payment at the end |  |  |  |  |
|  | of period n |  | E |  | BAL |
| 4 | For a new case go to step 2 and |  |  |  |  |
|  | change the appropriate |  |  |  |  |
|  | variables |  |  |  |  |

## Examples

## Problem Statement:

A "third party" leasing firm is considering the purchase of a mini-computer priced at $\$ 63,000$ and intends to achieve a $13 \%$ annual yield by leasing the computer to a customer for a 5 year period. Ownership is retained by the leasing firm, and at the end of the lease they expect to be able to sell the equipment for at least $\$ 10,000$. What should they establish as the monthly payments in order to realize their desired yield?

## Keystrokes See Displayed

63000 D 13 ENTER4 12 - B 5 ENTER4
$12 \boldsymbol{x}$ A 10000 E C $\longrightarrow 1300.16$

## Problem Statement:

The $\$ 1,300.16$ monthly lease payment calculated in the previous problem is thought to be too much. What would the resale value have to be at the end of five years if the monthly payments were reduced to $\$ 1,200$ ?


## Problem Statement:

The leasing firm of the two previous examples is not yet satisfied. A resale value of $\$ 18,494$ five years from now is considered to be too high. In fact, $\$ 14,000$ is the largest resale value that they are willing to plan on. With a $\$ 14,000$ resale value, and leaving the monthly payments at $\$ 1,200$ and the yield rate at $13 \%$ what purchase price will they have to negotiate in order to satisfy their requirements?

| Keystrokes <br> 14000 E D $\longrightarrow$ | See Displayed <br> 60645.71 |
| :--- | :--- |

## PRESENT VALUE ANNUITY DUE WITH BALLOON PAYMENT SOLVE FOR i



## Description:

This program will calculate the periodic interest rate (i) given values for the other four variables (n, PMT, PV and BAL).
(See Appendix E for comments on iterative solutions.)


## Examples

## Problem Statement:

A local truck dealer is offering to lease an $\$ 80,000$ off-highway diesel truck for 5 years and monthly payments of $\$ 1,625$. In addition the customer may acquire ownership by exercising a $10 \%$ purchase option ( $\$ 8,000$ in this case) at the end of the lease. What annual yield rate is the dealer achieving if the purchase option is exercised?

Keystrokes

## See Displayed

```
80000 D 5 ENTER4 12 X A 1625 C
8000 E B 92(.92\% monthly rate)
12 x
(an annual yield rate of 11.03%)
```


## Problem Statement:

If the purchase option in the above example is not exercised, ownership will be retained by the dealer. The best estimate of the resale value of the truck at the end of the lease is $\$ 6,500$. What is the yield for the dealer if the customer does not choose to exercise the purchase option?

| Keystrokes | See Displayed |
| :---: | :---: |
| 6500 E B | $\rightarrow .88$ |
|  | (.88\% monthly yield rate) |
| $12 \times$ | $\rightarrow 10.56$ |
|  | nual yield rate of 10.56\%) |

## SAVINGS-COMPOUNDING PERIODS DIFFERENT FROM PAYMENT PERIODS




## Description:

Payments into a savings plan may not occur with the same frequency as the compounding frequency offered. This program solves for either the periodic payment amount (given future value) or future value (given the payment amount).

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

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

The unlabeled D key does not have the protective programming described on page 113 of appendix B. If pressed by mistake the user will not be alerted with blinking zeroes and stack register values will be lost. No other damage is done however, and the user can continue operations in sequence.

| STEP | INSTRUCTIONS | $\begin{array}{c}\text { INPUT } \\ \text { DATA/UNITS }\end{array}$ | KEYS | OUTPUT |
| :--- | :--- | :--- | :--- | :--- |
| DATA/UNITS |  |  |  |  |$)$

## Examples

## Problem Statement:

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

See Displayed
7 ENTER4 4 X A 4 ENTER4 12 A
5 ENTER4 $12 \square \mathbf{B} 95$ C E $\longrightarrow 3203.59$

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## Problem Statement:

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

| Keystrokes |  |
| :--- | :--- |
| 100 C E $\longrightarrow$ | See Displayed |
| 3372.20 |  |

## Problem Statement:

Again assume the two previous calculations have just been performed, but the interest rate is changed to $6 \%$ and a future value of $\$ 6,000$ is desired. Determine the quarterly payment amount required.

| Keystrokes | See Displayed |
| :--- | :--- | :--- |
| $6 \boxed{\text { ENTER }} 12\left[\begin{array}{l}\text { B } 6000 \text { E C }\end{array}\right.$ | 171.24 |

## Problem Statement:

Deposits of $\$ 1500$ per month are to be made into an account paying $7 \%$ compounded daily ( 365 days per year). What sum will be in the account after 1 year?

Keystrokes See Displayed
12 A 12 ENTER4 $365 \square$ A 7 ENTER4
$365 \square$ B 1500 C E $\xrightarrow{\square} 18699.33$

## NOMINAL TO EFFECTIVE/EFFECTIVE TO NOMINAL RATE CONVERSION



## Decscription:

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.

This card actually contains two independent programs. The first, associated with $\mathbf{A}, \mathbf{B}$, and $\mathbf{C}$, addresses 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 nominal rate by the number of compounding periods in a year will give the required periodic interest rate.

The second program, associated with $\mathbf{D}$ and $\mathbf{E}$, is for continuous compounding. Given either rate, the other can be calculated.

The most common and straightforward definition of effective interest rate has been implemented. 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 | $\begin{array}{c}\text { INPUT } \\ \text { DATA/UNITS }\end{array}$ | KEYS | OUTPUT |
| :---: | :--- | :--- | ---: | ---: |
| DATA/UNITS |  |  |  |  |$)$

## Examples

## Problem Statement:

An investment with monthly cash flows (implying monthly compounding) is said to have an annual effective yield (interest rate) of $21 \%$. What annual (nominal) yield and periodic yield does this represent?


## Problem Statement:

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

| Keystrokes |  |
| :--- | :--- |
| $5 \mathrm{D} E \mathrm{E} \longrightarrow$ | See Displayed <br> (an annual effective rate of $5.13 \%$ ) |

# DIRECT REDUCTION LOAN ACCUMULATED INTEREST/REMAINING BALANCE 




## Description:

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.


## Example

## Problem Statement:

A mortgage is arranged such that the first payment is made at the end of October, 1973 (i.e., October is payment period 1). It is a $\$ 20,000$ loan at $7 \%$, with monthly payments of $\$ 141.40$. What is the accumulated interest for 1973 (periods 1-3) and 1974 (periods $4-15$ ) and what would the remaining balance be at the end of each year?

Keystrokes
See Displayed
1A 3 A 7 ENTER4 12 - B 20000 D 141.40 C E
(remaining balance at the end of 1973)


## DIRECT REDUCTION LOAN <br> AMORTIZATION SCHEDULE



Loan Amt: \$30,000 Apr: 7\% Monthly Payment: \$200

| Payment <br> Number | Paid To <br> Interest | Paid To <br> Principal | Remaining <br> Balance | Total Interest <br> Paid To Date |
| :---: | :---: | :---: | :---: | :---: |
| 1 | 175.00 | 25.00 | $29,975.00$ | 175.00 |
| 2 | 174.85 | 25.15 | $29,949.85$ | 349.85 |


| 36 | 169.36 | 30.64 | $29,001.75$ | 6.201 .75 |
| :--- | :--- | :--- | :--- | :--- |

## Description:

Given the periodic interest rate (i), periodic payment amount, (PMT), loan amount (PV) and payment number ( K ) this program will generate the values for a loan amortization schedule as pictured above, starting with the payment number entered for K. (The schedule may be started at any desired payment number).

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.

[^0]| STEP | INSTRUCTIONS | INPUT DATA/UNITS |  | KEYS | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in |  |  |  |  |
|  | - first period of the desired |  |  |  |  |
|  | schedule (need not be 1) | K | A |  |  |
|  | - periodic interest rate | i (\%) | B |  |  |
|  | - periodic payment amount | PMT | C |  |  |
|  | - initial loan amount | PV | D |  |  |
| 3 | Calculate amount paid to |  |  |  |  |
|  | interest for period K |  | E |  | PMT to INT |
| 4 | Calculate amount paid to |  |  |  |  |
|  | principal for period K |  | E |  | PMT to PRIN |
| 5 | Calculate remaining balance |  |  |  |  |
|  | at the end of period K |  | E |  | BAL |
| 6 | Calculate total interest paid |  |  |  |  |
|  | between periods 1 to K |  |  |  |  |
|  | inclusive |  | E |  | TOT INT |
| 7 | Increment K for next period |  |  |  |  |
|  | and go to step 3 for next |  |  |  |  |
|  | period's values |  | E |  | $K+1$ |
| 8 | For new case go to step 2 and |  |  |  |  |
|  | change appropriate input values. |  |  |  |  |

## Example

## Problem Statement:

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. (Note that these answers are shown in the figure on the previous page).

## Keystrokes

## See Displayed

1 A 7 ENTER4 $12 \div$ B 200 C 30000 D E $\longrightarrow 175.00$
(payment to interest)
E
25.00
(payment to principal)
E
29975.00
(remaining balance)
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$E \longrightarrow \underset{\text { (payment to principal) }}{ } 25.15$

$\mathrm{E} \longrightarrow \longrightarrow$| 29949.85 |
| :---: |
| (remaining balance) |

E
349.85
(total interest to date)

## Keystrokes

## See Displayed

Now let's skip ahead to the 36th payment period.

$\mathrm{E} \longrightarrow \longrightarrow \begin{gathered}\text { (remaining balance) } \\ \text { (total interest to date) }\end{gathered}$
E
37.00
(starting 37 th period)

## ADD-ON RATE INSTALLMENT LOAN



## Description:

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 Annual Percentage Rate to be quoted with the loan. The calculation of the Annual Percentage Rate considers these odd days.
(See Appendix E for comments on iterative solutions.)

## Note:

The payment amount (PMT) must be calculated in order to calculate the Annual Percentage Rate on card 2.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter card 1 |  |  |  |  |
| 2 | Key in |  |  |  |  |
|  | - number of monthly pay- |  |  |  |  |
|  | ments | $N$ | A |  |  |
|  | - "odd-days" to beginning of |  |  |  |  |
|  | of first month (0-30) | ODD | B |  |  |
|  | - add-on interest rate | AIR (\%) | C |  |  |
|  | - Ioan amount | AMT | D |  |  |
| 3 | Calculate monthly payment |  | E |  | PMT |
| 4 | Optional-calculate total finance |  |  |  |  |
|  | charge |  | E |  | FC |
| 5 | Enter card 2 |  |  |  |  |
| 6 | Calculate the annual percentage |  |  |  |  |
|  | rate |  | A |  | APR (\%) |

## Example

## Problem Statement:

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

See Displayed
Enter card 1


E 640.36
(total finance charge)
Now enter card 2
A
10.89
(10.89\% APR)

## CONSTANT PAYMENT TO PRINCIPAL LOAN AMORTIZATION SCHEDULE



## Loan Amount: \$100,000 Term: 20 Years, Annual Payments Annual Interest Rate: 8\% <br> Constant Payment To Principal: \$5,000

| Payment <br> Number <br> $(\mathbf{k})$ | Payment To <br> Interest <br> $\left(\mathrm{INT}_{\mathbf{k}}\right)$ | Payment <br> Amount <br> $\left(\mathrm{PMT}_{\mathbf{k}}\right)$ | Remaining <br> Balance <br> $\left(\mathrm{BAL}_{\mathbf{k}}\right)$ | Total Interest <br> To Date <br> $\left(I N T_{\mathbf{1}-\mathbf{k}}\right)$ |
| :---: | :---: | :---: | :---: | :---: |
| 1 | $8,000.00$ | $13,000.00$ | $95,000.00$ | $8,000.00$ |
| 2 | $7,600.00$ | $12,600.00$ | $90,000.00$ | $15,600.00$ |

## Description:

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 toward the principal and a decreasing amount towards interest.

This program calculates the values shown in the schedule above. The constant payment to principal required as input data (CPP) 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 .


## Example

## Problem Statement:

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 an amortization schedule for this loan. (See the schedule shown on the previous page.)

Keystrokes
See Displayed
1 A 8 B 5000 C 100000 D E
8000.00
(1st year's payment to interest)
E
13000.00
(total 1st payment)
50
$E$

(Now starting 2nd period)
E

(2nd year's payment to interest)
E 2600.00
(total 2nd payment)
E
90000.00
(remaining balance)
E
15600.00
(total interest paid to date)

## INTEREST REBATE-RULEOF 78'S



## Description:

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

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key-in all of the following: |  |  |  |  |
|  | - total number of monthly |  |  |  |  |
|  | payments | $N$ | A |  |  |
|  | - number of the last payment |  |  |  |  |
|  | made | K | B |  |  |
|  | - monthly payment amount | PMT | C |  |  |
|  | - total finance charge | FC | D |  |  |
| 3 | Calculate the unearned interest |  |  |  |  |
|  | (Rebate) |  | E |  | REB |
| 4 | Calculate the remaining balance |  | E |  | BAL |
| 5 | For a new case go to step 2 |  |  |  |  |
|  | and change appropriate inputs. |  |  |  |  |

## Example

## Problem Statement:

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 and remaining balance after the 25 th payment?
(unearned interest for payments 26 to 30 ) UP TO 12 CASH FLOWS


## Description:

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 (also called discounted rate of return or yield). Given the initial investment and up to 12 cash flows, this program calculates the periodic IRR. If more than 12 cash flows are entered, all cash flows over 12 will be ignored. There will be no indication, however, that more than 12 cash flows have been entered.

Zero should be entered for periods with no cash flow. This program cannot be used for problems with negative cash flows. All inputs must be positive values.

In many instances other programs may be more suitable for calculating IRR. If all cash flows are equal and equally spaced, program 3 is recommended. If all cash flows except the last are equal and equally spaced, program 5 is more suitable. If there are seven or less uneven cash flows program 22 is a better choice.

The user is asked to enter the largest cash flow in step 2 because of unique storage techniques being employed. This value is then used to scale all other cash flows, and depending on these values, accuracy may be reduced. Consequently, the resulting periodic rate of return should be considered accurate to within $\pm .01 \%$ (. 0001 decimal). This largest cash flow must be entered again in sequence at step 3.

If a cash flow larger than the value entered for CF MAX is keyed in at step 3, erroneous results are likely.

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.

Unlabeled keys must not be pressed! If an unlabeled key is pressed by mistake, begin again at step 1 and reenter card 1 .
(See Appendix E for comments on iterative solutions.)


Example

## Problem Statement:

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?

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| 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 |
|  |  |  | (CF MAX) |

Keystrokes See Displayed
311406 A 46423 B 40710 B 36638 B
34097 B 32485 B 23199 B 21612 B
20037 B 18460 B 311406 B 250000 C
Card 2 is entered at this point
$A \longrightarrow 13.98$

# INTERNAL RATE OF RETURN UP TO 7 CASH FLOWS 



## Description:

This program also calculates the periodic rate of return that will equate an initial investment to the present value of all future cash flows. By limiting the maximum number of cash flows to 7 , this program is able to calculate answers more quickly and more accurately $( \pm .001 \%)$ than program 21.

Zero should be keyed in for periods with no cash flow, and negative values (using CHS ) should be entered for periods with cash outlays (See Appendix E for cautions applicable to negative values).

Errors will result if more than 7 cash flows are entered. Registers 1 thru 7 are used to store cash flows 1 thru 7 respectively. Therefore, should some doubt exist as to what has been entered the input data may be recalled ( RCL ) for review.

Unlabeled keys $\mathbf{D}$ and $\mathbf{E}$ should not be pressed. If pressed by mistake begin again at step 1 by reentering the magnetic card.


## Example

## Problem Statement:

A shopping center requires a $\$ 200,000$ investment, and will be sold at the end of 3 years. If this investment results in the semi-annual net cash flows shown below, what is the internal rate of return?

| End of <br> Six Month Period | Cash Flow |
| :---: | :---: |
| 1 | $\$ 0$ |
| 2 | 9000 |
| 3 | 11000 |
| 4 | 11000 |
| 5 | 13000 |
| 6 | 212,000 |
|  | (includes net proceeds from sale) |

Keystrokes
See Displayed
0 A 9000 A 11000 A 11000 A
13000 A 212000 A 200000 B C
4.53
(a semi-annual IRR of 4.53\%)
2

(an annual IRR of 9.06\%)

# DISCOUNTED CASH FLOW ANALYSIS NET PRESENT VALUE 



## Description:

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 $\mathbf{C}$ (\#) and then the amount only once with $\mathbf{D}$ (CF). If, however, a cash flow occurs only once there is no need to enter a 1 with $\mathbf{C}$.

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 programs 2 or 4 by simply entering zero as the initial investment.


## Example

## Problem Statement:

Would an investment of $\$ 260,000$ projected to generate the cash flows listed below be considered profitable if the desired annual yield is $9 \%$ ?

| End of Year | Cash Flow | End of Year | Cash Flow |
| :---: | :---: | :---: | :---: |
| 1 | $-\$ 1000$ | 6 | 30000 |
| 2 | 0 | 7 | 30000 |
| 3 | 0 | 8 | 30000 |
| 4 | 23000 | 9 | 30000 |
| 5 | 28000 | 10 | 250000 |

Keystrokes

## See Displayed

260000 A 9 B 1000 CHS D $\longrightarrow-260917.43$
(NPV after 1st cash flow)
2 C 0 D
(NPV after 3 cash flows)
E
3.00
(checking that we've entered 3 period's cash flows so far)

$23000 \mathrm{D} \longrightarrow$| $\longrightarrow-244623.65$ |
| :---: |
| (NPV after 4 cash flows) |
|  |
| $28000 \mathrm{D} \longrightarrow-226425.57$ |
| (NPV after 5 cash flows) |

Keystrokes
4 C $30000 \mathrm{D} \longrightarrow$
(NPV after 9 cash flows)

## E

9.00
(9 period's cash flows entered so far)

$$
250000 \mathrm{D} \longrightarrow \text { (NPV after } 10 \text { cash flows) }
$$

After the tenth and last cash flow the net present value is still negative and therefore the investment does not meet profit objectives.

## STRAIGHT LINE DEPRECIATION SCHEDULE



Schedule - Straight-Line Method
Starting Book Value: $\$ 375,000$ Salvage Value: $\$ 30,000$
Estimated Useful Life: 40 Years

| Year <br> (End of) | Depreciation <br> Amount <br> (DEP) | Remaining <br> Depreciable <br> Value (RDV) | Remaining <br> Book Value <br> (RBV) | Depreciation <br> To Date <br> (Reserve) |
| :---: | :---: | :---: | :---: | :---: |
| 1 | $8,625.00$ | $336,375.00$ | $366,375.00$ | $8,625.00$ <br> $17,250.00$ <br> 2 |
| $8,625.00$ | $327,750.00$ | $357,750.00$ |  |  |
| 15 | $8,625.00$ | $215,625.00$ | $245,625.00$ | $129,375.00$ |

## Description:

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 data shown in the schedule above, given 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 lives 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.

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 numbers, 1.0, 2.0, 17.0 etc.) may be entered for YR (above the $\mathbf{D}$ key). The program makes no checks on this value and generates invalid results if other than whole numbers are entered.

| STEP | INSTRUCTIONS | $\begin{array}{c}\text { INPUT } \\ \text { DATA/UNITS }\end{array}$ | KEYS |
| :---: | :--- | :--- | :--- | :--- |
| DATA/UNITS |  |  |  |$)$

## Example

## Problem Statement:

Produce the schedule shown on the previous page. That is, for a starting book value of $\$ 375,000$, a salvage value of $\$ 30,000$ and an expected life of 40 years, generate the schedule information for the first two years. Then jump ahead to the 15 th year and generate the data for that year.

## Keystrokes

(remaining depreciable value)


Now jump ahead to the 15th year
$15 \mathrm{D} \mid \mathrm{E} \longrightarrow \mathbf{( 1 5 \text { th year's depreciation) }} 8 \mathbf{} 8625.00$
E
215625.00
(remaining depreciable value)
E
245625.00
(remaining book value)
E
129375.00
(total depreciation after 15 years)

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## SUM OF THE YEARS' DIGITS DEPRECIATION SCHEDULE



Depreciation Schedule - Sum of the Years Digits Method Starting Book Value: $\$ 375,000$ Salvage Value: $\mathbf{\$ 3 0 , 0 0 0}$

Expected Useful Life: 40 Years

| Year <br> (End of) | Depreciation <br> Amount <br> (DEP) | Remaining <br> Depreciable <br> Value (RDV) | Remaining <br> Book Value <br> (RBV) | Depreciation <br> To Date <br> (Reserve) |
| :---: | :---: | :---: | :---: | :---: |
| 1 | $16,829.27$ | $328,170.73$ | $358,170.73$ | $16,829.27$ <br> 2 |
| $16,408.54$ | $311,762.20$ | $341,762.20$ | $33,237.80$ |  |
| 15 | $10,939.02$ | $136,737.80$ | $166,737.80$ | $208,262.20$ |

## Description:

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 data shown in the above schedule 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.

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 numbers, 1.0, 2.0 17.0 , etc.) may be entered for YR (above the $\mathbf{D}$ key). The program makes no checks on this value and generates invalid results if other than whole numbers are entered.

Finally, unlike most programs in this pac, this program depends on values in the operational stack for successive depressions of the $\mathbf{E}$ (SKED) key. Thus, intermediate calculations between generating "sked" values are not permitted. Should this happen however, recovery is accomplished by simply keying in the appropriate value for YR (D) and generating the values again.

| STEP | INSTRUCTIONS | $\begin{array}{c}\text { INPUT } \\ \text { DATA/UNITS }\end{array}$ | KEYS | CUTPUT |
| :---: | :--- | :--- | :--- | :--- | :--- |
| DATA/UNITS |  |  |  |  |$)$

## Example

## Problem Statement:

Generate values for the first and fifteenth year for a $\$ 375,000$ asset that has a salvage value of $\$ 30,000$ and an expected life of 40 years. (This schedule is shown on the previous page.)


We could continue pressing $\mathbf{E}$ to generate the 2nd and subsequent years' values. However, we'll jump ahead to the 15 th year.


E
$\longrightarrow 166737.80$
(remaining book value)
E
208262.20
(total depreciation 1st through 15th year)
E
I
$\longrightarrow$ (now entering 16th year)
Etc.

# VARIABLE RATE DECLINING BALANCE DEPRECIATION SCHEDULE <br>  

Depreciation Schedule - Declining Balance Method Starting Book Value: \$375,000 Salvage Value: \$30,000

Expected Useful Life: 40 Years Rate: 1.5

| Year <br> (End of) | Depreciation <br> Amount <br> (DEP) | Remaining <br> Depreciable <br> Value (RDV) | Remaining <br> Book Value <br> (RBV) | Depreciation <br> To Date <br> (Reserve) |
| :---: | :---: | :---: | :---: | :---: |
| 1 | $14,062.50$ | $330,937.50$ | $360,937.50$ | $14,062.50$ |
| 2 | $13,535.16$ | $317,402.34$ | $347,402.34$ | $22,597.66$ |


| 15 | $8,235.18$ | $181,369.51$ | $211,369.51$ | $163,630.49$ |
| :--- | :--- | :--- | :--- | :--- |

## Description:

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. This program generates the data shown in the above 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 (C) 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.

This program will not allow an asset to be depreciated below its salvage value. That is when the generated depreciation for a year, usually the last, is greater than the remaining depreciable value, the latter is displayed as the depreciation amount. Program 27 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 lives must be entered as an integer plus a fraction however. Thus, a life of 12 years 3 months would be keyed in as 12.25 .

Values for the last year of an asset with fractional years life (i.e., the 21st year's values of 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 numbers 1.0, 2.0, 17.0, etc.) may be entered for YR (above the $\mathbf{D}$ key). The program makes no checks on this value and will generate invalid results if other than whole numbers are entered.


## Example

## Problem Statement:

Generate the values for the 1 st and 15 th year in the schedule shown on the previous page. Also calculate the remaining depreciable value in the 40th (last) year.


We could continue calculating the second year's values but we'll jump ahead to the 15th year.


Jumping ahead to the 40th year.
40 $\mathrm{DE} \longrightarrow$
$\mathrm{E} \longrightarrow$
(40th year's depreciation)

(remaining depreciable value)

Note that in the last year of the asset's life there would still be a total of $\$ 51,294.43$ of remaining depreciable value on the books if this schedule were used throughout the asset's life. (See program 27)

## CROSSOVER POINT-DECLINING BALANCE TO STRAIGHT LINE



## Description:

As indicated in the description and example for program 26, 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 program 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. Should there be no optimum crossover point, this condition will be indicated by blinking zeroes. This implies that the declining balance method is "best" for the entire depreciable life.

Thus, this program (27), the declining balance depreciation program (26), and the straight line depreciation program (24) may be used as follows:
A. This program is used to determine the "crossover point" and associated values.
B. Program 26 is entered and a declining balance depreciation schedule is generated for the early years up to and including the year indicated as being the "last year"

Note that since the depreciation programs use the same storage register conventions, only a value for YR ( D ) need be keyed in for program 26.
C. Finally, program 24 is entered. The remaining book value at the end of the last "declining balance year" is keyed in for starting
book value ( $\mathrm{SBV}-\mathrm{A}$ ), and the remaining life is keyed in for the asset's life (LIFE-C ). There is no need to enter the salvage value as it has been retained throughout this process. A straight line depreciation schedule may now be generated for the remaining years.

Note that for this portion of the depreciation schedule the value for "total depreciation to date" (reserve) will be in error by an amount equal to the amount depreciated during the declining balance calculations.

As in program 26, the declining balance factor (FACT) should be entered in factor form $(1.25,1.5,2.0)$, not as a percent $(125,150$, 200).

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in all of the following: |  |  |  |  |
|  | - starting book value |  |  |  |  |
|  | (beginning basis) | SBV | A |  |  |
|  | - salvage value | SAL | B |  |  |
|  | - life of the asset | LIFE | C |  |  |
|  | - declining rate factor |  |  |  |  |
|  | $(1<$ FACT $\leqslant 2)$ | FACT | D |  |  |
| 3 | Calculate last year to use declin- |  |  |  |  |
|  | ing balance method |  | E |  | Last Year |
| 4 | Calculate remaining life |  | E |  | Rem Life |
| 5 | Calculate remaining book value |  | E |  | RBV |
| 6 | For new case go to step 2 and |  |  |  |  |
|  | change appropriate values |  |  |  |  |

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## Problem Statement:

An asset has a starting book value of $\$ 375,000$, a 40 year life expectancy, and a projected salvage value of $\$ 30,000$. Using a 1.5 declining balance factor:

1. Determine the crossover point and the associated remaining life and remaining book value with program 27.
2. Generate the depreciation data for the declining balance "last year" with program 26. (Normally the user would generate a full schedule beginning with the 1 st year).
3. Switching to the straight line method (program 24), generate the depreciation data for the year following the declining balance "last year".

Keystrokes
See Displayed
Enter program 27.
375000 A 30000 B 40 C 1.5 D ( E $\longrightarrow 18.00$
E

(remaining book value after 18th year)
Now enter program 26.


Now enter program 24.

NOTE: That while 1 was keyed in for YR-the first year of straight line depreciation-this is the 19th year of the asset's life.

E
151267.78
(remaining depreciable value)
E
181267.78
(remaining book value) etc.

## DAYS BETWEEN DATES (ACTUAL)



## Description:

This program calculates the actual number of days between any two dates that occur between January 1, 1901 and December 31, 2099. The earlier date is keyed in for DT1 ( A ), the later date is keyed in for DT2 ( B ) and the calculation is performed by pressing C (DAYS).

Both 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 (October 2, 1970 is keyed in as 10.021970). The program does not check input data, however. Thus, if an improper format is used, or a date outside of the 1901 to 2099 limits is entered, 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 the Bond Price and Bond Yield programs (30, 31, and 32). When the settlement date is entered for DT1 and the redemption date (maturity date, call date, etc.) is entered for DT2, pressing C also causes the number of remaining semiannual coupon periods to be stored for use by these bond programs. The number of semiannual coupon periods 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).

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 DT1 if the settlement date is different.

Unlabeled keys D and E are not protected as described in Appendix B and should not be pressed. If pressed by mistake, DT1 and DT2 must be keyed in again prior to performing the DAYS calculation.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in the following: |  |  |  |  |
|  | - earliest date (DT 1) | MM.DDYYYY | A |  |  |
|  | - latest date (DT 2) | MM.DDYYYY | B |  |  |
| 3 | Calculate the number of days |  |  |  |  |
|  | between the two dates |  | C |  | DAYS |
| 4 | For new case go to step 2 and |  |  |  |  |
|  | change DT 1 and/or DT 2 as |  |  |  |  |
|  | appropriate. |  |  |  |  |

## Example

## Problem Statement:

Calculate the number of days between February 1, 1965 and November 7, 1989.

| Keystrokes | See Displayed |
| :--- | :--- |
| 2.011965 A 11.071989 B C $\longrightarrow$ | 9045.00 |

## Problem Statement:

Having just performed the above calculation, now calculate the number of days between February 1, 1965 and March 15, 1991.

## Keystrokes

See Displayed
3.151991 B C
9538.00

## DAYS BETWEEN DATES (30/360 BASIS)



## Description:

This program calculates the number of days between any two dates on a $30 / 360$ basis ( 30 day month, 360 day year), as is the custom for many securities. The earliest date is keyed in for DT1 ( A ), the latest date is keyed in for DT2 ( $\mathbf{B}$ ), and the calculation is performed by pressing C (DAYS).

Both 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 (October 2, 1970 is keyed in as 10.021970). The program does not check input data however. Thus if an improper date format is used, or an invalid date is keyed in (e.g., February 30), erroneous answers will result.

An important feature of this program is that it is designed to be used in conjunction with the Bond Price and Bond Yield programs (30, 31, and 32). When the settlement date is entered for DT1 and the redemption date (maturity date, call date, etc.) is entered for DT2, pressing C also causes the number of semiannual coupon periods to be stored for use by these bond programs. The number of semiannual coupon periods is determined 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 DT1 if the settlement date is different.

Unlabeled keys $\mathbf{D}$ and $\mathbf{E}$ are not protected as described in Appendix B and should not be pressed. If pressed by mistake, DT1 and DT2 must be keyed in again prior to performing the DAYS calculation.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in the following: |  |  |  |  |
|  | - Earliest date (DT 1) | MM.DDYYYY | A |  |  |
|  | - Latest date (DT 2) | MM.DDYYYY | B |  |  |
| 3 | Calculate the days between the |  |  |  |  |
|  | two dates |  | C |  | DAYS |
| 4 | For a new case go to step 2 and |  |  |  |  |
|  | change DT 1 and/or DT 2 as |  |  |  |  |
|  | appropriate |  |  |  |  |

## Examples

## Problem Statement:

Calculate the number of days between February 1, 1965 and November 7, 1989.

| Keystrokes | See Displayed |
| :--- | :--- |
| 2.011965 A 11.071989 B C $\longrightarrow$ | 8916.00 |

## Problem Statement:

Having just performed the above calculation, now calculate the number of days between February 1, 1965 and March 15, 1991.
Keystrokes See Displayed

## BOND PRICE



## Description:

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

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 5 and may be recalled ( RCL 5 ).

Each time the coupon rate is entered by pressing $\mathbf{B}$, 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, if either of the calendar programs are used for calculating the number of remaining coupon periods, the settlement date is retained throughout the bond calculations and need not be reentered when returning to programs 28 or 29 for another bond calendar calculation.

The number of remaining coupon periods between settlement date and redemption date can be calculated and entered in two ways. If one of the calendar programs ( 28 or 29 ) is used to calculate the number of days between settlement date and redemption date, the number of remaining semiannual coupon periods is automatically
calculated and stored in register 1 for use by the bond programs. 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 programs is deemed inappropriate, it can 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.

While the bond programs are optimized for semiannual coupon bonds, they may be used for bonds with more or less frequent coupon periods. The procedure is to adjust the number of remaining coupon periods, the coupon rate, and the yield rate prior to calculating the price (a sample problem is included in the examples).

| STEP | $\begin{array}{c}\text { INSTRUCTIONS }\end{array}$ | $\begin{array}{c}\text { INPUT } \\ \text { DATA/UNITS }\end{array}$ | KEYS |
| :--- | :--- | :--- | :--- | :--- | :--- |
| DATA/UNITS |  |  |  |$)$

## Examples

## Problem Statement:

What is the price of a semiannual $3 \%$ bond to yield $10 \%$ if purchased on January 1, 1972. The bond matures March 6, 1978. (Use the 30/360 calendar-program 29.)

Keystrokes
See Displayed
Enter program 29

### 1.011972 A 3.061978 B C $\longrightarrow 2225.00$ (days settlement to maturity, 30/360 basis)

Now enter program 30


Problem Statement:
Having performed the above calculation, determine the price of the same bond using the "actual calendar", program 28. Remember, the settlement date has been retained and need not be reentered.

## Keystrokes

See Displayed
Enter program 28
3.061978 B C $\longrightarrow 2256.00$

Enter program 30


## Problem Statement:

The bond described above is callable on March 6, 1975 at a call price of 102. What is the price-to-call if the actual calendar is used? (If these problems are solved in the sequence shown the settlement date is still available).

## Keystrokes

See Displayed
Enter program 28
3.061975 B C

Now enter program 30

```
3 B 10 C 102 D E
82.81
(price-to-call)
```


## Problem Statement

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? (Use the 30/360 calendar, program 29.)

## Keystrokes

## See Displayed

Enter program 29


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


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.)


# BOND YIELD (1 OR MORE REMAINING COUPON PERIODS) 



## Description:

This program calculates the annual yield of a semiannual coupon bond when there are one or more remaining coupon periods between settlement and redemption dates. Data required for input are the number of coupon periods (PER, A ) between settlement date and redemption date (maturity date, call date, etc.), the annual coupon rate expressed as a percent (CR, B ), the bond price (PRICE, C ), and the redemption value (RV, D ) if other than 100.

All comments concerning data entry, data definitions, and calendar calculations mentioned in the description of the Bond Price program apply to this program.

If the value entered for the number of remaining coupon periods is less than 1 , blinking zeroes will appear in the display after pressing $\boldsymbol{E}$. To review the value entered in step 3 below or stored by the calendar programs (28 or 29) simply press RCL 1 CHS (for programming reasons the number of coupon periods is stored as a negative number). Program 32 is intended for yield calculations when there is a fraction of a coupon period remaining between the settlement and redemption dates.

This program and program 32 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. (A sample problem is shown in the examples.) This can be important when comparing a bond with taxable coupons to one whose coupons are tax free.
The programs 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 simply to treat the exit date and price as the redemption date and redemption value respectively. The yield calculated is the precise yield if the exit date is also a coupon date, and is an approximate yield for other exit dates.

Finally, this program may be used for bonds with other than semiannual coupon periods. The number of remaining coupon periods, and the coupon rate must be adjusted as indicated in the description and examples of the Bond Price program. The yield is calculated by pressing $\mathbf{E}$ and then dividing the result by the same factor used to adjust the coupon rate.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: |
| 1 | Optional-use program 28 or |  |  |  |
|  | 29 to calculate the number of |  |  |  |
|  | remaining coupon periods |  |  |  |
| 2 | Enter this program |  |  |  |
| 3 | Key in |  |  |  |
|  | - number of remaining coupon |  |  |  |
|  | periods (may be omitted if |  |  |  |
|  | step 1 is performed) | PER | A |  |
|  | - annual coupon rate | CR (\%) | B |  |
|  | - bond price | PRICE | C |  |
| 4 | Key in redemption value if |  |  |  |
|  | other than 100. | RV | D |  |
| 5 | Calculate the annual yield |  | E | YLD (\%) |
| 6 | 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 . |  |  |  |

## Examples

## Problem Statement:

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

## Keystrokes

Enter program 29
11.151973 A 2.061980 B C $\longrightarrow 2241.00$
(days settlement to call)
Enter program 31
5 B 101 D 99 C E $\longrightarrow 5.33$
(yield-to-call)
Enter program 29

Enter program 31
5 B 99 C E 5.08
(yield-to-maturity)

## Problem Statement:

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

## See Displayed

First, calculate and enter the after tax value of the coupon.
5 ENTER4 ENTER4. $4 \boldsymbol{x} \boldsymbol{B} \longrightarrow 3.00$
(net after tax coupon)
Now calculate and enter the net after tax proceeds when the bond is redeemed for 100 at maturity.


D 99.75
(net proceeds from bond redemption)
(The price and remaining coupon periods have been retained from the previous calculation.)


## BOND YIELD <br> (LESS THAN 1 REMAINING COUPON PERIOD)



## Description:

This program calculates the annual yield of a semiannual coupon bond when there is less than one coupon period remaining between settlement and redemption dates. Data required for input are the fraction of a coupon period remaining (PER, $A$ ), the annual coupon rate expressed as a percent (CR, B ), the bond price (PRICE, C ), and the redemption value (RV, D ) if other than 100. All comments in the description of programs 30 (Bond Price) and 31 (Bond Yield) concerning data entry, data definitions and calendar calculations apply to this program.
If the value entered for the number of remaining coupon periods is equal to or greater than one, blinking zeroes will appear in the display after pressing $E$. To review the value entered in step 3 below or stored by the calendar programs ( 28 or 29 ) simply press RCL 1 CHS (for programming reasons the number of coupon periods is stored as a negative number).


## Examples

## Problem Statement:

A U.S. Treasury Note with a $5.75 \%$ coupon and 88 days from settlement to maturity is purchased at $10018 / 32$. If there are assumed to be 183 days in a coupon period, what is the yield-to-maturity?

Keystrokes See Displayed
5.75 B 88 ENTER4 $183 \div 0.48$
(fraction of a coupon period remaining)

(annual yield-to-maturity)

## Problem Statement:

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 See Displayed
88 ENTER4 $182 \square$ A $\mathrm{O} \longrightarrow 3.35$
(annual yield-to-maturity)

## ACCRUED SIMPLE INTEREST



## Description:

This program calculates the accrued simple interest given the number of days, annual interest rate, and the initial principal. Answers based on a 360 or 365 day year are made available. In addition, the user may choose to add the calculated accrued interest to the initial principal to determine the final amount.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in |  |  |  |  |
|  | - number of days | DAYS | A |  |  |
|  | - annual interest rate | RATE (\%) | B |  |  |
|  | - beginning amount | BEG AMT | C |  |  |
| 3 | Calculate either or both: |  |  |  |  |
|  | - accrued interest (360 day |  |  |  |  |
|  | year) |  | D |  | INT 360 |
|  | and final amount (optional) |  | + |  | FIN AMT |
|  | and/or |  |  |  |  |
|  | - accrued interest (365 day |  |  |  |  |
|  | year) |  | E |  | INT 365 |
|  | and final amount (optional) |  | $+$ |  | FIN AMT |
| 4 | For a new case go to step 2 and |  |  |  |  |
|  | change the appropriate values |  |  |  |  |

## Example

## Problem Statement:

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 See Displayed
30000 C 8 B 90 A D D\longrightarrow 600.00
    (Interest, 360 day basis)
\square\longrightarrow30600.00
    (Final amount, 360 day basis)
E \longrightarrow}591.7
    (Interest, 365 day basis)
\longrightarrow\longrightarrow30591.78
    (Final amount, 365 day basis)
```


## LINEAR REGRESSION (TREND LINE)



## Description:

This program performs a least squares linear regression given a series of x , y data pairs as input. 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 an independent ( x ) and dependent ( y ) variable and is of the form:

$$
y=m x+b
$$

where:
$\mathrm{y}=$ dependent variable
$\mathrm{m}=$ slope of the straight line
$\mathrm{x}=$ independent variable
$\mathrm{b}=$ the value of y when $\mathrm{x}=0$, called the " y -intercept."
In addition to calculating values for the slope and $y$-intercept this program also provides the coefficient of determination $\mathrm{r}^{2}$. 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 .

Having determined the equation (first depression of the $\mathbf{D}$ key), the user can then project estimates of y values for given x values.

| STEP | INSTRUCTIONS | $\begin{array}{c}\text { INPUT } \\ \text { DATA/UNITS }\end{array}$ | KEYS | OUTPUT |
| :---: | :--- | :--- | :--- | :--- |
| DATA/UNITS |  |  |  |  |$]$

## Examples

## Problem Statement:

A commercial land appraiser has examined 3 vacant lots in the downtown section of a local community, all of which have the same depths but different frontages and values as shown below. Based on this data, what is the relationship between frontage and lot value? What predicted value would a lot have with a 65 foot frontage? With a 50 foot frontage?

Lot Frontage (feet)
70.8
60.0
85.0

Lot Value
\$10,100.00
\$ 8,219.00
\$15,000.00

Keystrokes
See Displayed


## Problem Statement:

Assume that the above problem has just been performed as shown and additional data (listed below) has become available. Key in this data and recalculate the projections.

| Lot Frontage (feet) | Lot Value |
| :---: | ---: |
| 75.2 | $\$ 11,120$ |
| 67.0 | 9,500 |

Keystrokes
See Displayed


## EXPONENTIAL CURVE FIT (GROWTH CURVE)



## Description:

Given a series of $x, y$ data pairs as input this program performs a least squares regression to determine the best exponential curve fit of the form:

$$
y=b e^{m x}
$$

where:
$y=$ dependent variable
$b=$ the value of $y$ when $x=0$, called the " $y$-intercept"
$\mathrm{e}=\mathrm{a}$ constant $(2.718281828)$
$\mathrm{m}=$ the slope or rate of growth of the curve
$\mathrm{x}=$ independent variable
This 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, (If a linear relationship is suspected, program 34 should be used). The value for $m$ 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 m is .10 . This means that over the measured period the stock has experienced a $10 \%$ continuous growth rate.

In addition to calculating values for the best exponential curve fit equation, this program also calculates the coefficient of determination, $r^{2}$. This is an indication of the "goodness of fit" and is a number between 0 and 1 . Values closer to 1 indicate a "better" fit than values closer to 0 .

Having determined the exponential curve fit equation (after first depression of $\mathbf{D}$ ), the user can then key in $x$ values and generate projected y values, by pressing E.
$y$ values input at step 3 below must be positive numbers.


## Example

## Problem Statement:

A stock's price history is listed below. What continuous growth rate does this represent? If the stock continues this growth rate, what is the price projected to be at the end of 1974 (year 5)?

End of Year
1970 (1)
1971 (2)
1972 (3)
1973 (4)
Keystrokes

## TOTAL, AVERAGE, AND PERCENT OF TOTAL (UP TO 8 ITEMS)



## Description:

This program computes a total for up to 8 items, calculates each item's percent of the total and determines the average value of all items entered. After pressing B in step 3 below, the display will show the number of items entered up to that point. If more than 8 items are entered, errors will occur when calculating answers.

| STEP | INSTRUCTIONS | $\begin{array}{c}\text { INPUT } \\ \text { DATA/UNITS }\end{array}$ | KEYS | CUTPUT |
| :---: | :--- | :--- | :--- | :---: | :---: |
| DATA/UNITS |  |  |  |  |$)$

## Example

## Problem Statement:

Five groups of a department have submitted the budgets shown below. Determine the department's total budget, each group's percent of the total, and the average budget size.

|  | Group | Budget |  |
| :---: | :---: | :---: | :---: |
|  | 1 | \$30,168 |  |
|  | 2 | 75,550 |  |
|  | 3 | 52,600 |  |
|  | 4 | 27,800 |  |
|  | 5 | 41,750 |  |
| Keystrokes |  | See Displayed |  |
| A 30168 B 1.00 |  |  |  |
| 75550 B $\longrightarrow 2.00$ |  |  |  |
| 52600 B $\longrightarrow 3.00$ |  |  |  |
| 27800 B 4.00 |  |  |  |
| 41750 B $\longrightarrow 5.00$ |  |  |  |
| $\text { C } \longrightarrow \longrightarrow \begin{gathered} 227868.00 \\ \text { (Total budget) } \end{gathered}$ |  |  |  |
|  |  |  |  |
|  |  |  |  |
| E |  |  |  |
| E |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

## MOVING AVERAGES



## Description:

This program calculates a 2 to 6 unit moving average. The user is asked to first indicate how many units are to be carried in the moving average (\#, A ). Next, values are keyed in (x, B ) until the number of values keyed in equals the number of units indicated. The first average is then calculated ( C ). After this, program operation consists of alternately keying in a value ( $\mathbf{B}$ ) and computing the moving average (C). Each time a new value is entered, the appropriate earlier value is automatically deleted. (e.g., when a 3 unit moving average is being maintained, entering the fourth value causes the first value to be subtracted and the fourth to be added to a running total, and so on for subsequent values.) Also, each time a value is entered by pressing $\mathbf{B}$, the display shows how many values have been entered thus far.

If a value other than $2,3,4,5$ or 6 is entered for the number of units (\#, A ) the calculator will blink zeroes when an attempt is made to calculate the moving average.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Input the number of units in |  |  |  |  |
|  | the moving average | \# | A |  |  |
| 3 | Input the first \# values | x | B |  |  |
| 4 | Compute the average of the last |  |  |  |  |
|  | \# values |  | C |  | AVG |
| 5 | Input the next value of $x$ and |  |  |  |  |
|  | go to step 4. | x | B |  |  |
|  | If no more values exist go to |  |  |  |  |
|  | step 6. |  |  |  |  |
| 6 | For new case go to step 2. |  |  |  |  |

## Example

## Problem Statement:

The number of widgets produced by a manufacturing line for the last ten successive work days is shown below. The line supervisor would like to compute a 5 workday moving average for his line crew's production over this period.

| DAY | WIDGETS | DAY | WIDGETS |
| :---: | :---: | :---: | :---: |
| 1 | 21,157 | 6 | 27,112 |
| 2 | 32,670 | 7 | 21,017 |
| 3 | 11,255 | 8 | 19,159 |
| 4 | 13,176 | 9 | 31,900 |
| 5 | 30,050 | 10 | 31,672 |
| Keystrokes |  |  | See Displayed |
| 5 A 21157 B 32670 B |  |  |  |
| 11255 B 3.00 |  |  |  |
| 13176 B 30050 B C |  |  | $\begin{aligned} & 21661.60 \\ & \text { erage, days } 1-5) \end{aligned}$ |
| 27112 B C |  |  | $\begin{aligned} & 22852.60 \\ & \text { erage, days } 2-6) \end{aligned}$ |
| 21017 B C |  |  | $\begin{aligned} & 20522.00 \\ & \text { erage, days } 3-7) \end{aligned}$ |
| 19159 B C |  |  | $\begin{aligned} & 22102.80 \\ & \text { erage, days } 4-8) \end{aligned}$ |
| 31900 B C |  |  | $\begin{aligned} & 25847.60 \\ & \text { erage, days } 5-9) \end{aligned}$ |
| 31672 B C |  |  | $\begin{aligned} & -26172.00 \\ & \text { rage, days } 6-10) \end{aligned}$ |

## INVOICING



## Description:

Given a discount rate (DISC), number of units (\#), and price per unit (PRICE) for each line item, this program calculates the net line total (N), and maintains a running subtotal (S) and grand total (G).

The net line total is the number of units multiplied by the unit price, less the discount amount. Each time it is calculated (first depression of the $E$ key), the value is added to both the running subtotal and the grand total. A second depression of the $\mathbf{E}$ key displays the running subtotal. A third depression clears the running subtotal accumulation (grand total is not affected). A fourth depression displays the grand total (without clearing it). The grand total is not cleared (set to zero) until you START (A key) a new problem.

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

If after calculating a net line total (first depression of $\boldsymbol{E}$ ) it is discovered that one or more of the input values has been keyed in erroneously, the following procedure may be used to correct the running subtotal and the grand total:

1. Regardless of which value was in error, key in the same price as a negative number, press $\mathbf{D}$ and then $\boldsymbol{E}$.
2. Now enter corrected input values for DISC or \#, be sure to key in a correct positive value for PRICE and then press $\boldsymbol{E}$.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |
| 2 | Initialize (START) |  | A | 0.00 |
| 3 | Key-in |  |  |  |
|  | - discount rate | DISC (\%) | B |  |
|  | - number of units | \# | C |  |
|  | - price per unit | PRICE | D |  |
| 4 | Calculate net line total |  | E | $N$ |
| 5 | Optional-display running sub- |  |  |  |
|  | total |  | E | S |
| 6 | Optional-clear running subtotal |  | E | 0.00 |
| 7 | Optional-display running |  |  |  |
|  | grand total |  | E | G |
| 8 | For additional items, same |  |  |  |
|  | grand total, go to step 3 and |  |  |  |
|  | change appropriate inputs. |  |  |  |
|  | For new case (clear everything) |  |  |  |
|  | go to step 2. |  |  |  |

## Example

## Problem Statement:

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, and what is the grand total to be paid?

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 | See Displayed |
| :---: | :---: |
| A 2 B 25 | 67.38 |
| 60 C 1.50 | 88.20 |
| 71 C E | 104.37 |
| E | $\begin{aligned} & 259.95 \\ & \text { (Subtotal-Bill 1) } \end{aligned}$ |
| E | $0.00$ <br> (Clear subtotal) |
| 12 C 10.50 | 123.48 |
| 17 C 37.20 | 619.75 |
| E | $\begin{aligned} & 743.23 \\ & \text { (Subtotal-Bill 2) } \end{aligned}$ |
| E | $0.00$ <br> (Clear subtotal) |

3 B 155 C. 28 D E $\longrightarrow 42.10$
$38 \mathrm{C} .92 \mathrm{DEE} \longrightarrow 33.91$
217 C. $56 \mathrm{DE} \longrightarrow 117.87$
E
193.88
(Subtotal-Bill 3)
$\mathrm{E} \longrightarrow 0.00$ (Clear subtotal)

E
1197.06
(Grand total)

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## Appendix A

## ENTERING A PROGRAM

Select a program card from the card case supplied with this application pac.

Set W/PRGM-RUN switch to RUN.
Turn the calculator ON. You should see 0.00 .
Gently insert the card (printed side up) in the right, lower slot as shown. When the card is part way in, the motor engages it and passes it out the left side of the calculator. Sometimes the motor engages but does not pull the card in. If this happens, push the card a little farther into the machine. Do not impede or force the card; let it move freely. (The display will flash if the card reads improperly. In this case, press CLX and reinsert the card.)


When the motor stops, remove the card from the left side of the calculator and insert it in the upper "window slot" on the right side of the calculator.

The program is now stored in the calculator. It remains stored until another program is entered or the calculator is turned off.

Entering a program into the HP-65 does not affect data in the operational stack (including the display) or in storage registers.


## Appendix B <br> THE PRERECORDED MAGNETIC CARDS



The magnetic cards themselves contain important information. The discussion that follows refers to the magnetic card shown above.

The titles, ADD-ON RATE LOAN in this case, suggest the principle intended usage. They are generally the same as the program titles in the Table of Contents, but occasionally they have been shortened because of space limitations.

Mnemonics and abbreviations are printed at the extreme right (e.g., ADD-ON) to facilitate identification when the program cards are in the plastic carrying case.

FIN $1-18 \mathrm{~A} 1$ is the identification number of the magnetic card shown. It indicates that this card is a member of FINANCE PAC 1 (FIN 1) and that this is the first card (1) of the first release (A) of program number 18. If this were the only card for program 18 the number would have been simply FIN 1-18A. Thus, the presence of a digit at the end of the identification number indicates that there are multiple cards for a single program, and the program instructions should be consulted for proper operation.

Finally, descriptive labels appear above each of the user definable keys for which programmed functions exist. These labels suggest the function to be performed but should not be relied upon until the user has familiarized himself with the individual program instructions. There are several label conventions which apply throughout the pac:

1. Labels that are not enclosed in squares (e.g., N, ODD, AIR, and AMT) identify data input (only) functions.
2. Labels that are enclosed in squares (e.g., $\stackrel{P \mathrm{FMT}}{\mathrm{FC}}$ ) are used to identify functions that will generate answers (i.e., data output) using the available input values. In most programs, functions so labeled are only used for data output. However, programs 2,4 , $6,8,10,12,14$ and 15 use these functions for both data input and data output (see Appendix D also).
3. User definable keys that have no associated labels should not be pressed. However, most programs alert the user with flashing zeroes when an unlabeled key is pressed by mistake. In addition the original contents of the display and T register are lost. No other damage is done. The user need only press CLX and continue operations in sequence. (Programs 14, 21, 22, 28, and 29 do not have this protection. The consequences of pressing an unlabeled key and recovery procedures are described in the instructions for these programs.)

## Appendix C

## FORMAT OF USER INSTRUCTIONS

The completed User Instruction Form is your guide to operating programs in this pac.

The form is composed of five labeled columns. Reading from left to right, the first column, labeled STEP, gives the instruction step number.

The INSTRUCTIONS column gives instructions and comments concerning the operations to be performed. Operations should be performed in step number sequence, except when they are indicated as being optional or the instruction directs the user to an out of sequence step. However, when there are several operations associated with a single step number, these operations may be performed in any sequence. After pressing a user definable key for either data input or data output operations, any intermediate calculation may be performed so long as it does not affect storage registers required by the program. Finally, since most programs retain input data, reentry of unchanged data is not required unless otherwise indicated.

The INPUT-DATA/UNITS column specifies the input data and the units of data, if applicable. Data input keys consist of the numeric keys 1 to $9, \square$ (decimal point), EEX (enter exponent), and CHS (change sign).

The KEYS column specifies the keys to be pressed. The ENTERA key is shown simply as $\dagger$. All other designations are identical to those appearing on the HP-65. Ignore any blank spaces in the KEYS columns.

The OUTPUT-DATA/UNITS column specifies intermediate and final outputs and their units, where applicable.

The instructions shown are for Accrued Simple Interest, FIN 1-33A.

| STEP | INSTRUCTIONS | INPUT DATA/UNITS | KEYS |  | OUTPUT DATA/UNITS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | Enter program |  |  |  |  |
| 2 | Key in |  |  |  |  |
|  | - number of days | DAYS | A |  |  |
|  | - annual interest rate | RATE (\%) | B |  |  |
|  | - beginning amount | BEG AMT | C |  |  |
| 3 | Calculate either or both: |  |  |  |  |
|  | - accrued interest (360 day |  |  |  |  |
|  | year) |  | D |  | INT 360 |
|  | and final amount (optional) |  | $+$ |  | FIN AMT |
|  | and/or |  |  |  |  |
|  | - accrued interest (365 day |  |  |  |  |
|  | year) |  | E |  | INT 365 |
|  | and final amount (optional) |  | $+$ |  | FIN AMT |
| 4 | For a new case go to step 2 and |  |  |  |  |
|  | change the appropriate values |  |  |  |  |

STEP 1: The first step in all programs is to enter the prerecorded magnetic card into the HP-65.

STEP 2: The user is asked to key in three data inputs; the data may be keyed in in any sequence.

STEP 3: The user may calculate the accrued interest and final amount two ways. If both sets of values are desired either may be calculated first.

STEP 4: For a different simple interest calculation the user is directed back to step 2 to key in those values that are to be changed (indicating that input data are retained).

## Appendix D ADDITIONAL INFORMATION, PROGRAMS 1-17

## General

Programs 1 through 17 solve most of the business problems involving compound interest calculations and eliminate the need for the tables and interpolation formerly associated with the problems.

It is important to note that while these programs are titled according to the envisioned primary use, they are not restricted to the indicated applications. For example program 2 would be used to determine (among other things) the number of periodic payments required to fully amortize a loan. The identical circumstances exist when determining how many periodic withdrawals can be made from a savings account with a given initial deposit. Therefore, program 2 would be used for this problem as well.

## Labels Enclosed in a Square

As indicated in Appendix B, functions associated with labels enclosed in a square on the magnetic cards for programs $2,4,6,8$, $10,12,14$, and 15 are both data input and data output functions. To distinguish between data intended for input and a request for a calculation, these functions use a simple technique. The value in the display is tested, and if it is not equal to zero the value is considered input data and is stored in the proper storage register. A value of zero in the display is a request that the appropriate calculation be performed. (While a value of zero has to be in the display to perform the calculation the user is not required to key in zeroes during normal operation-data input functions accomplish this.)

## Label Definitions

The labels described below are associated with the same user definable key every time each is used, and they are associated with the same data storage registers throughout the series. A summary of this information is shown on page 5 for quick reference.

The label $n$ appears above the A key. Its associated value is stored in register 1. Except for program 14, this value is the total number of payment periods and/or compounding periods. When both exist, payment periods and compounding periods are assumed to be equal
in duration and to occur coincidently. That is, payments occur every time compounding takes place and vice versa.

Often the term of a compound interest problem is stated in years, with other data implying the number of compounding/payment periods per year. A loan, for example, may be quoted as having monthly payments for 30 years (implying that there are 12 compounding/payment periods per year). In this case the proper input data can be determined by multiplying the number of periods per year by the number of years (i.e., $12 \times 30$ or 360 payments) prior to pressing $\mathbf{A}$.

The label i appears above the B key. The associated value is stored (as a decimal value) in register 2 . The value to be input, or generated as output is the periodic interest rate expressed as a percent.

The prevailing practice in the United States is to state interest rates (yield, rate of return, growth rate, etc.) as an annual percent, intending that this value be divided by the number of compounding periods per year to determine the periodic interest rate. Nominal Interest Rates quoted for savings accounts, the Annual Percentage Rate required by truth-in-lending laws, and Yield to Maturity for bonds are examples of this common practice. Therefore, when the annual interest rate is given in this manner, it should be divided by the number of compounding periods per year prior to pressing the B key. Conversely, periodic interest rates generated by pressing B have to be multiplied by the number of compounding periods per year to find the annual interest rate.

## PMT

This label appears above the C key; its associated value is stored in register 3. This value is the equal periodic payment occurring once per compounding period for the number of periods associated with n .

Payments may occur at either the beginning of a period or at the end of the period, depending on the problem. Ordinary annuity and payments in arrears are common terms applied to the situation where periodic payments occur at the end of payment periods. A direct reduction loan (mortgage) is a prime example of an application belonging in this category. When payments are to be made at the beginning of payment periods, they may be referred to
as an annuity due or payments in advance. Leases for example, are often constructed as an annuity due.

Programs 2 through 7 and 15 through 17 are for ordinary annuity problems. Programs 8 through 14 address annuities due. To assist you in selecting the program that applies to your particular problem, the descriptions of each program contain a diagram showing the time relationships of the variables involved.

## PV

This label appears above the $\mathbf{D}$ key. Its associated value is stored in register 4. This value is the initial base amount (present value, initial principal, initial investment, price, beginning balance, etc.) at the beginning of the first period.

## FV

This label appears above the $\mathbf{E}$ key. Its associated value is stored in register 5. This value is the final amount (future value, compounded amount, future sum, etc.) at the end of the last period. No program with PMT as a variable uses both PV and FV as variables.

## BAL

This label appears above the $\mathbf{E}$ key and its associated value is stored in register 5. This value is the balloon payment amount or remaining balance that occurs at the end of the last period.

Programs that use this variable $(4,5,12,13)$ also use $n$, $\mathrm{i}, \mathrm{PMT}$, and PV and are characterized as having a series of equal periodic payments terminated by an unequal payment at the end of the last period. For programs 4 and 5 , where payments occur at the end of payment periods, the balloon payment amount is in addition to the last payment.

No program uses both BAL and FV.

Appendix E

## OPERATING CHARACTERISTICS

The programs in this pac were designed to accommodate the wide range of values that business conditions can be expected to impose. Since the HP-65 uses a full ten digits for all calculations, a higher level of accuracy is attained than might be achievable with tables, slide rules, and less accurate calculators. There is, however, a possibility that certain values may cause apparent anomalies, and the following material is presented as guidelines to the user. When additional guidelines apply, they appear with the individual program instructions.

## Range Limits

Programs 1 through 13 are designed for optimum operation when the input data are positive non-zero values. Negative or zero values may cause the programs to halt with a display of all 9's, zero, or flashing zeros. (See Iterative Solutions below.)

Financial calculations requiring a value for the periodic interest rate (i) should not be performed when that periodic interest rate is very close or equal to zero. Specifically, periodic interest rates between $+.0000001 \%$ and $-.0000001 \%$ are not handled.

Solutions for the number of payment and/or compounding periods (n) are not always possible. For example, in program 2, if the periodic payment amount (PMT) is less than the first period's interest charge ( $\mathrm{PV} \cdot \mathrm{i} / 100$ ), the remaining balance will always be increasing and the loan can never be repaid, no matter how long payments are made. Similiar conditions exist for programs 4, 10, and 12. When these programs attempt to solve for n under these conditions, the result will be a display of flashing zeroes.

Finally, since these programs are subject to the operating limits of the HP-65 itself, extreme values may cause error conditions. For example, if program 1 (Compound Amount) were used to calculate the future value ( FV ) with $\mathrm{n}=2500, \mathrm{i}=10 \%$ and $\mathrm{PV}=1$, the program halts with a display of all 9's indicating that the answer is larger than the machine's capacity.

## Iterative Solutions

The mathematical properties of the equations for programs $3,5,7$, $9,11,13,18,21,22$, and 31 are such that there is no direct (closed form) solution for the interest rates (i, APR, IRR, and YLD). These
programs use an iteration technique to solve for the interest rate. That is, they generate a "best guess" interest rate, test it, improve the answer based on the test, test it again, and so on until an acceptable answer is achieved. How much the answer is improved has a direct bearing on both the accuracy of the answer and the length of time the calculation takes. The programs using this technique produce answers that are accurate to $\pm .0001 \%$. The time to calculate these answers is also longer than the user will normally experience with other programs. Depending upon input values, it may take minutes to arrive at a solution.

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

Another design assumption associated with these iterative solutions is that all required input data are positive values. Again, the programs often produce satisfactory answers when negative values are used, but they may also halt prematurely with flashing zeroes in the display, indicating that the program cannot solve the problem. More importantly, for programs 5, 13, and 22, a condition can be created such that more than one interest rate is considered correct in a mathematical sense. These programs may in fact calculate and display one of these answers, but have no way of indicating when more than one answer exists or what the other values might be. Therefore, caution should be exercised when negative input values are used in these programs.

## Matching Answers With Another Source

Occasionally, apparent discrepancies occur when comparing program answers with those produced by another source. Frequently, these discrepancies will be small, but disconcerting nonetheless, and can often be attributed to a different degree of accuracy maintained by the two sources. Remember, the HP-65 uses a full ten digits. Many tables truncate or round to fewer digits, or require manual interpolation for some values.

Another possible source of these discrepancies is that two slightly different approaches may have been used. Comparing the equations used by the programs with those of sources producing the "different" answers should resolve these questions.

## Appendix F <br> 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 Compound Amount

$$
F V=P V(1+i)^{n}
$$

2,3 Direct Reduction Loan

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

4,5 Direct Reduction Loan with Balloon Payment

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

6,7 Sinking Fund

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

8,9 Periodic Savings, Annuity Due

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

10, 11 Present Value, Annuity Due

$$
P V=P M T\left[\frac{(1+i)-(1+i)^{-n+1}}{i}\right]
$$

12, 13 Present Value, Annuity Due with Balloon Payment

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

14 Savings-Compounding Periods
Different From Payment Periods

$$
P M T=\frac{F V}{Z}\left[\frac{Q}{(1+Q)^{K}-1}\right]
$$

when

$$
\begin{aligned}
& \mathrm{P} / \mathrm{C} \leqslant 1 \\
& \mathrm{Q}=(1+\mathrm{i})^{\mathrm{C} / \mathrm{P}}-1 \\
& \mathrm{Z}=(1+\mathrm{Q}) \\
& \mathrm{K}=\# \mathrm{PAY}
\end{aligned}
$$

when $\quad \mathrm{P} / \mathrm{C}>1$

$$
\mathrm{Q}=\mathrm{i}
$$

$$
K=(\# P A Y) \times(C / P)
$$

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

15 Nominal to Effective/Effective to Nominal Rate Conversion finite compounding

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

continuous compounding

$$
\mathrm{EFF}=\left(\mathrm{e}^{\mathrm{NOM}}-1\right)
$$

16 Accumulated Interest/Remaining Balance

$$
\begin{aligned}
\mathrm{BAL}_{\mathrm{K}} & =\frac{1}{(1+\mathrm{i})^{-K}}\left[\operatorname{PMT} \frac{(1+\mathrm{i})^{-K}-1}{\mathrm{i}}+\mathrm{PV}\right] \\
\mathrm{Int}_{\mathrm{J}-\mathrm{K}} & =\mathrm{BAL}_{\mathrm{K}}-\mathrm{BAL}_{\mathrm{J}-1}+(\mathrm{K}-\mathrm{J}+1) \cdot \mathrm{PMT}
\end{aligned}
$$

17 Amortization Schedule

$$
\operatorname{BAL}_{K}=\frac{1}{(1+i)^{-K}}\left[\operatorname{PMT} \frac{(1+i)^{-K}-1}{i}+P V\right]
$$

$\mathrm{k}^{\text {th }}$ payment to principal $=\mathrm{BAL}_{\mathrm{K}-1}-\mathrm{BAL}_{\mathrm{K}}$
$\mathrm{k}^{\text {th }}$ payment to interest $=\mathrm{PMT}-\left(\mathrm{BAL}_{\mathrm{K}-1}-\mathrm{BAL}_{\mathrm{K}}\right)$
Total payment to interest $=(\mathrm{K}) \times(\mathrm{PMT})-\left(\mathrm{PV}-\mathrm{BAL}_{\mathrm{K}}\right)$

18 Add-on Rate Installment Loan

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

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

$$
\mathrm{APR}=12 \mathrm{i}
$$

where $\mathrm{h}=$ ODD • $12 / 365$
19 Constant Payment to Principal Loan
Amortization Schedule

$$
\begin{gathered}
\mathrm{BAL}_{\mathrm{K}}=\mathrm{PV}-(\mathrm{K} \times \mathrm{CPP}) \\
\mathrm{k}^{\text {th }} \text { payment to interest }=(1+\mathrm{i}) \mathrm{BAL}_{\mathrm{K}-1}=\left(\mathrm{PMT}_{\mathrm{i}}\right)_{\mathrm{K}} \\
\mathrm{k}^{\text {th }} \text { total payment }=\mathrm{CPP}+\left(\mathrm{PMT}_{\mathrm{i}}\right)_{\mathrm{K}}
\end{gathered}
$$

20 Interest Rebate - Rule of 78's

$$
\operatorname{REBATE}_{\mathrm{K}}=(\mathrm{N}-\mathrm{K}) \cdot\left[\frac{\mathrm{FC}(\mathrm{~N}-\mathrm{K}+1)}{\mathrm{N} \times(\mathrm{N}+1)}\right]
$$

$$
\mathrm{BAL}_{\mathrm{K}}=(\mathrm{N}-\mathrm{K}) \cdot \mathrm{PMT}-\mathrm{REBATE}_{\mathrm{K}}
$$

21, 22 Internal Rate of Return
Solve for IRR in:

$$
I N V=\sum_{j=1}^{n} \frac{C F_{j}}{(1+I R R)^{j}}
$$

where: $\mathrm{n}=$ number of cash flows

$$
\mathrm{CF}_{\mathrm{j}}=\mathrm{j}^{\text {th }} \text { cash flow }
$$

23 Discounted Cash Flow Analysis - Net Present Value

$$
N P V_{k}=-I N V+\sum_{k=1}^{n} \frac{C F_{k}}{(1+i)^{k}}
$$

where: $\mathrm{n}=$ number of cash flows
$\mathrm{CF}_{\mathrm{k}}=\mathrm{k}^{\text {th }}$ cash flow
$\mathrm{NPV}_{\mathrm{k}}=$ net present value after $\mathrm{k}^{\text {th }}$ cash flow

124 Appendix F
Depreciation

$$
\begin{aligned}
& \mathrm{K}=\text { value for YR } \\
& \mathrm{TOTDEP}_{\mathrm{K}}=\text { total depreciation for years } 1 \\
& \quad \text { through } \mathrm{K} .
\end{aligned}
$$

$$
\mathrm{DEP}_{\mathrm{K}}=\frac{\mathrm{SBV}-\mathrm{SAL}}{\text { LIFE }}
$$

$$
\mathrm{DEP}_{\mathrm{K}}(\text { last year })=\left(\frac{\mathrm{SBV}-\mathrm{SAL}}{\mathrm{LIFE}}\right) \cdot \mathrm{F}
$$

$$
\operatorname{TOTDEP}_{\mathrm{K}}=(\mathrm{K}) \cdot\left(\frac{\mathrm{SBV}-\mathrm{SAL}}{\mathrm{LIFE}}\right)
$$

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

$$
\mathrm{RBV}_{\mathrm{K}}=\mathrm{RDV}_{\mathrm{K}}+\mathrm{SAL}
$$

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

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

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

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

$$
\mathrm{RBV}_{\mathrm{K}}=\mathrm{RDV}_{\mathrm{K}}+\mathrm{SAL}
$$

$$
\begin{gathered}
\mathrm{DEP}_{\mathrm{K}}=\mathrm{SBV} \cdot\left(1-\frac{\mathrm{FACT}}{\mathrm{LIFE}}\right)^{\mathrm{K}-1} \cdot\left(\frac{\mathrm{FACT}}{\mathrm{LIFE}}\right) \\
\mathrm{TOTDEP}_{\mathrm{K}}=\mathrm{SBV} \cdot\left[1-\left(1-\frac{\mathrm{FACT}}{\mathrm{LIFE}}\right)^{\mathrm{K}}\right] \\
\mathrm{RDV}_{\mathrm{K}}=(\mathrm{SBV}-\mathrm{SAL})-\mathrm{TOTDEP}_{\mathrm{K}} \\
\mathrm{RBV}_{\mathrm{K}}=\mathrm{RDV}_{\mathrm{K}}+\mathrm{SAL}
\end{gathered}
$$

27 Crossover Point - Declining Balance to Straight Line
$\operatorname{SBV}\left(1-\frac{\text { FACT }}{\text { LIFE }}\right)^{\mathrm{K}-1} \cdot\left(\frac{\text { FACT }}{\text { LIFE }}\right)>\frac{(\mathrm{SBV}-\mathrm{SAL})-\text { TOTDEP }_{\mathrm{K}-1}}{\mathrm{~L}+1-\mathrm{K}}$
where TOTDEP $_{\mathrm{K}-1}$ is determined as shown in program 26.
The largest integer value for K which maintains the above relationship is the "last year" to use the Declining Balance depreciation method.

28 Days Between Dates (Actual)

$$
\text { DAYS }=f(D T 2)-f(D T 1)
$$

where
$f(D T)=365($ yyyy $)+31(m m-1)+d d+\operatorname{Int}(z / 4)-x$
and

$$
\text { for } \mathrm{mm} \leqslant 2
$$

$$
x=0, \quad z=(y y y y)-1
$$

for $\mathrm{mm}>2$
$x=\operatorname{Int}(.4 \mathrm{~mm}+2.3), \quad \mathrm{z}=$ (yyyy)
Int $=$ Integer portion

Days Between Dates (30/360 Basis)

$$
\begin{gathered}
\text { DAYS }=\mathrm{f}(\mathrm{DT} 2)-\mathrm{f}(\mathrm{DT} 1) \\
\mathrm{f}(\mathrm{DT})=360(\text { yyyy })+30 \mathrm{~mm}+\mathrm{z}
\end{gathered}
$$

for f (DT1)

$$
\text { if } \mathrm{dd}_{1}=31 \text { then, } \mathrm{z}=30
$$

$$
\text { if } \mathrm{dd}_{1} \neq 31 \text { then } \mathrm{z}=\mathrm{dd}_{1}
$$

for f (DT2)
if $\mathrm{dd}_{2}=31$ and $\mathrm{dd}_{1}=30$ or 31 then $\mathrm{z}=30$
if $\mathrm{dd}_{2}=31$ and $\mathrm{dd}_{1}<30$ then $\mathrm{z}=\mathrm{dd}_{2}$
if $\mathrm{dd}_{2}<31$ then $\mathrm{z}=\mathrm{dd}_{2}$
30,31,32 Bond Price and Yield
for PER > 1

$$
\begin{gathered}
\text { PRICE }=R V\left(1+\frac{Y L D}{2}\right)^{-\mathrm{PER}}+100 \frac{\mathrm{CR}}{\mathrm{YLD}}\left[\left(1+\frac{\mathrm{YLD}}{2}\right)^{\mathrm{J}}\right. \\
\left.-\left(1+\frac{\mathrm{YLD}}{2}\right)^{-\mathrm{PER}}\right]-100\left(\frac{\mathrm{CR}}{2}\right) \mathrm{J}
\end{gathered}
$$

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

$$
\begin{aligned}
\text { FRAC }(\mathrm{PER})= & \text { fractional portion of the number } \\
& \text { of remaining coupon periods }
\end{aligned}
$$

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

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

33 Accrued Simple Interest

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

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

34 Linear Regression

$$
\text { for } y=b+m x
$$

$$
\begin{gathered}
\mathrm{m}=\frac{\Sigma \mathrm{x}_{\mathrm{i}} \mathrm{y}_{\mathrm{i}}-\frac{\Sigma \mathrm{x}_{\mathrm{i}} \Sigma \mathrm{y}_{\mathrm{i}}}{\mathrm{n}}}{\Sigma \mathrm{x}_{\mathrm{i}}^{2}-\frac{\left(\Sigma \mathrm{x}_{\mathrm{i}}\right)^{2}}{\mathrm{n}}} \\
\mathrm{~b}=\overline{\mathrm{y}}-\mathrm{m} \overline{\mathrm{x}}
\end{gathered}
$$

where

$$
\begin{gathered}
\overline{\mathrm{x}}=\frac{\Sigma \mathrm{x}_{\mathrm{i}}}{\mathrm{n}} \quad \overline{\mathrm{y}}=\frac{\Sigma \mathrm{y}_{\mathrm{i}}}{\mathrm{n}} \\
\mathrm{r}^{2}=\frac{\left[\Sigma \mathrm{x}_{\mathrm{i}} \mathrm{y}_{\mathrm{i}}-\frac{\Sigma \mathrm{x}_{\mathrm{i}} \Sigma \mathrm{y}_{\mathrm{i}}}{\mathrm{n}}\right]^{2}}{\left[\Sigma \mathrm{x}_{\mathrm{i}}^{2}-\frac{\left(\Sigma \mathrm{x}_{\mathrm{i}}\right)^{2}}{\mathrm{n}}\right]\left[\Sigma \mathrm{y}_{\mathrm{i}}^{2}-\frac{\left(\Sigma \mathrm{y}_{\mathrm{i}}\right)^{2}}{\mathrm{n}}\right]} \\
\mathrm{n}=\text { number of data pairs }
\end{gathered}
$$

35 Exponential Curve Fit

$$
\begin{gathered}
y=b e^{m x} \quad(b>0) \\
m=\frac{\Sigma x_{i} \ln y_{i}-\frac{1}{n}\left(\Sigma x_{i}\right)\left(\Sigma \ln y_{i}\right)}{\Sigma x_{i}^{2}-\frac{1}{n}\left(\Sigma x_{i}\right)^{2}} \\
r^{2}=\frac{\exp \left[\frac{\Sigma \ln y_{i}}{n}-m \frac{\Sigma x_{i}}{n}\right]}{\left[\Sigma x_{i}^{2}-\frac{\left(\Sigma x_{i}\right)^{2}}{n}\right]\left[\Sigma\left(\ln y_{i}\right)^{2}-\frac{\left(\Sigma \ln y_{i}\right)^{2}}{n}\right]} \\
n=n u m b e r \text { of data pairs }
\end{gathered}
$$

## 128 Appendix F

36 Total, Average, and Percent of Total (Up to 8 Items)

$$
\begin{gathered}
\mathrm{TOT}=\mathrm{x}_{1}+\mathrm{x}_{2} \ldots \mathrm{x}_{\mathrm{N}} \\
\mathrm{AVG}=\frac{\mathrm{TOT}}{\mathrm{~N}}, \quad(\%)_{\mathrm{K}}=\frac{\mathrm{x}_{\mathrm{K}}}{\mathrm{TOT}} \times 100
\end{gathered}
$$

where $\mathrm{N}=$ number of items $(\mathrm{N} \leqslant 8)$

37 Moving Averages

$$
\mathrm{AVG}_{K}=\frac{\mathrm{x}_{\mathrm{K}}+\mathrm{x}_{\mathrm{K}+1}+\ldots \mathrm{x}_{\mathrm{K}+\mathrm{N}-1}}{\mathrm{~N}}
$$

where $\quad N=$ number of items in moving average $(N \leqslant 6)$
$K=$ the $k^{\text {th }}$ item in a series of items

38 Invoicing

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

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## COMPOUND AMOUNT

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| LBL | 23 | ${ }^{1} / \mathrm{x}$ | 04 | RCL 2 | 3402 |
| A | 11 | g | 35 | 1 | 01 |
| STO 1 | 3301 | $y^{x}$ | 05 | + | 61 |
| 0 | 00 | 1 | 01 | RCL 1 | 3401 |
| $g x \neq y$ | 3521 | - | 51 | g | 35 |
| 0 | 00 | STO 2 | 3302 | $y^{x}$ | 05 |
| RTN | 24 | EEX | 43 | x | 71 |
| RCL 5 | 3405 | 2 | 02 | STO 5 | 3305 |
| RCL 4 | 3404 | X | 71 | RTN | 24 |
| $\div$ | 81 | RTN | 24 | LBL | 23 |
| f | 31 | LBL | 23 | C | 13 |
| LN | 07 | D | 14 | 0 | 00 |
| RCL 2 | 3402 | STO 4 | 3304 | $\div$ | 81 |
| 1 | 01 | 0 | 00 | RTN | 24 |
| + | 61 | $g \mathrm{x} \neq \mathrm{y}$ | 3521 | g NOP | 3501 |
| f | 31 | 0 | 00 | g NOP | 3501 |
| LN | 07 | RTN | 24 | g NOP | 3501 |
| $\div$ | 81 | RCL 5 | 3405 | g NOP | 3501 |
| STO 1 | 3301 | RCL 2 | 3402 | g NOP | 3501 |
| RTN | 24 | 1 | 01 | g NOP | 3501 |
| LBL | 23 | + | 61 | g NOP | 3501 |
| B | 12 | RCL 1 | 3401 | g NOP | 3501 |
| EEX | 43 | g | 35 | g NOP | 3501 |
| 2 | 02 | $\mathrm{y}^{\mathrm{x}}$ | 05 | g NOP | 3501 |
| $\div$ | 81 | $\div$ | 81 | g NOP | 3501 |
| STO 2 | 3302 | STO 4 | 3304 | g NOP | 3501 |
| 0 | 00 | RTN | 24 | g NOP | 3501 |
| $\mathrm{g} x \neq y$ | 3521 | LBL | 23 | g NOP | 3501 |
| 0 | 00 | E | 15 | g NOP | 3501 |
| RTN | 24 | STO 5 | 3305 | g NOP | 3501 |
| RCL 5 | 3405 | 0 | 00 |  |  |
| RCL 4 | 3404 | $g x \neq y$ | 3521 |  |  |
| $\div$ | 81 | 0 | 00 |  |  |
| RCL 1 | 3401 | RTN | 24 |  |  |
| g | 35 | RCL 4 | 3404 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | n | $\mathbf{R}_{\mathbf{4}}$ | PV | $\mathbf{R}_{\mathbf{7}}$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}} \mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ | FV | $\mathbf{R}_{\mathbf{8}}$ |  |  |
| $\mathbf{R}_{\mathbf{3}}$ | $\mathbf{R}_{\mathbf{6}}$ |  | $\mathbf{R}_{\mathbf{9}} \quad$ Used |  |  |

DIRECT REDUCTION LOAN
SOLVE FOR n, PMT, or PV

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| LBL | 23 | STO 3 | 3303 | $\mathrm{y}^{\mathrm{x}}$ | 05 |
| A | 11 | 0 | 00 | - | 51 |
| STO 1 | 3301 | $\mathrm{g} x \neq y$ | 3521 | RCL 2 | 3402 |
| 0 | 00 | 0 | 00 | $\div$ | 81 |
| $\mathrm{g} x \neq y$ | 3521 | RTN | 24 | x | 71 |
| 0 | 00 | RCL 4 | 3404 | STO 4 | 3304 |
| RTN | 24 | 1 | 01 | RTN | 24 |
| 1 | 01 | RCL 2 | 3402 | LBL | 23 |
| RCL 4 | 3404 | 1 | 01 | E | 15 |
| RCL 3 | 3403 | + | 61 | 0 | 00 |
| $\div$ | 81 | RCL 1 | 3401 | $\div$ | 81 |
| RCL 2 | 3402 | CHS | 42 | RTN | 24 |
| x | 71 | g | 35 | g NOP | 3501 |
| - | 51 | $\mathrm{y}^{\mathrm{x}}$ | 05 | g NOP | 3501 |
| f | 31 | - | 51 | g NOP | 3501 |
| LN | 07 | RCL 2 | 3402 | g NOP | 3501 |
| 1 | 01 | $\div$ | 81 | g NOP | 3501 |
| RCL 2 | 3402 | $\div$ | 81 | g NOP | 3501 |
| + | 61 | STO 3 | 3303 | g NOP | 3501 |
| f | 31 | RTN | 24 | g NOP | 3501 |
| LN | 07 | LBL | 23 | g NOP | 3501 |
| $\div$ | 81 | D | 14 | g NOP | 3501 |
| CHS | 42 | STO 4 | 3304 | g NOP | 3501 |
| STO 1 | 3301 | 0 | 00 | g NOP | 3501 |
| RTN | 24 | $g \mathrm{x} \neq \mathrm{y}$ | 3521 | g NOP | 3501 |
| LBL | 23 | 0 | 00 | g NOP | 3501 |
| B | 12 | RTN | 24 | g NOP | 3501 |
| EEX | 43 | RCL 3 | 3403 | g NOP | 3501 |
| 2 | 02 | 1 | 01 | g NOP | 3501 |
| $\div$ | 81 | RCL 2 | 3402 | g NOP | 3501 |
| STO 2 | 3302 | 1 | 01 |  |  |
| 0 | 00 | + | 61 |  |  |
| RTN | 24 | RCL 1 | 3401 |  |  |
| LBL | 23 | CHS | 42 |  |  |
| C | 13 | g | 35 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | n | $\mathbf{R}_{\mathbf{4}}$ PV | $\mathbf{R}_{\mathbf{7}}$ |
| :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ | $\mathbf{R}_{\mathbf{8}}$ |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ | $\mathbf{R}_{\mathbf{9}}$ Used |

## DIRECT REDUCTION LOAN SOLVE FOR INTEREST RATE (i)

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | 00 | 1 | 01 | CHS | 42 |
| $\div$ | 81 | + | 61 | 6 | 06 |
| LBL | 23 | STO 6 | 3306 | $\mathrm{g} x \leqslant y$ | 3522 |
| A | 11 | RCL 1 | 3401 | GTO | 22 |
| STO 1 | 3301 | g | 35 | 1 | 01 |
| RTN | 24 | $\mathrm{y}^{\mathrm{x}}$ | 05 | RCL 2 | 3402 |
| LBL | 23 | STO 7 | 3307 | EEX | 43 |
| C | 13 | RCL 4 | 3404 | 2 | 02 |
| STO 3 | 3303 | RCL 3 | 3403 | x | 7.1 |
| RTN | 24 | $\div$ | 81 | R/S | 84 |
| LBL | 23 | RCL 2 | 3402 | g NOP | 3501 |
| D | 14 | x | 71 | g NOP | 3501 |
| STO 4 | 3304 | 1 | 01 | g NOP | 3501 |
| RTN | 24 | - | 51 | g NOP | 3501 |
| LBL | 23 | x | 71 | g NOP | 3501 |
| B | 12 | 1 | 01 | g NOP | 3501 |
| RCL 3 | 3403 | + | 61 | g NOP | 3501 |
| RCL 4 | 3404 | RCL 2 | 3402 | g NOP | 3501 |
| $\div$ | 81 | x | 71 | g NOP | 3501 |
| $\uparrow$ | 41 | g LST X | 3500 | g NOP | 3501 |
| g | 35 | RCL 1 | 3401 | g NOP | 3501 |
| 1/x | 04 | x | 71 | g NOP | 3501 |
| RCL 1 | 3401 | RCL 6 | 3406 | g NOP | 3501 |
| $\uparrow$ | 41 | $\div$ | 81 | g NOP | 3501 |
| x | 71 | RCL 7 | 3407 | g NOP | 3501 |
| $\div$ | 81 | - | 51 | g NOP | 3501 |
| - | 51 | 1 | 01 | g NOP | 3501 |
| STO 2 | 3302 | + | 61 | g NOP | 3501 |
| 0 | 00 | $\div$ | 81 | g NOP | 3501 |
| $\mathrm{g} \mathrm{x}=\mathrm{y}$ | 3523 | STO | 33 | g NOP | 3501 |
| RTN | 24 | + | 61 |  |  |
| g NOP | 3501 | 2 | 02 |  |  |
| LBL | 23 | g | 35 |  |  |
| 1 | 01 | ABS | 06 |  |  |
| RCL 2 | 3402 | EEX | 43 |  |  |


| $\mathbf{R}_{\mathbf{1}} \mathrm{n}$ | $\mathbf{R}_{\mathbf{4}}$ PV | $\mathbf{R}_{\mathbf{7}} \quad(1+\mathrm{i} / 100)^{\mathrm{n}}$ |
| :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}} \mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ | $\mathbf{R}_{\mathbf{8}}$ |
| $\mathbf{R}_{\mathbf{3}}$ PMT | $\mathbf{R}_{\mathbf{6}} \quad \mathbf{1 + i} / \mathbf{1 0 0}$ | $\mathbf{R}_{\mathbf{9}} \quad$ Used |

## DIRECT REDUCTION LOAN WITH BALLOON <br> PAYMENT SOLVE FOR n, PMT, PV, or BAL

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| STO 1 | 3301 | 1 | 01 | 0 | 00 |
| 0 | 00 | + | 61 | RTN | 24 |
| $g \mathrm{x} \neq \mathrm{y}$ | 3521 | RCL 1 | 3401 | B | 12 |
| 0 | 00 | CHS | 42 | RCL 7 | 3407 |
| RTN | 24 | g | 35 | RCL 3 | 3403 |
| RCL 5 | 3405 | $y^{x}$ | 05 | x | 71 |
| RCL 3 | 3403 | STO 6 | 3306 | RCL 5 | 3405 |
| RCL 2 | 3402 | - | 51 | RCL 6 | 3406 |
| $\div$ | 81 | RCL 2 | 3402 | x | 71 |
| - | 51 | $\div$ | 81 | + | 61 |
| RCL 4 | 3404 | STO 7 | 3307 | STO 4 | 3304 |
| g LST X | 3500 | 0 | 00 | RTN | 24 |
| - | 51 | RTN | 24 | LBL | 23 |
| $\div$ | 81 | LBL | 23 | E | 15 |
| f | 31 | C | 13 | STO 5 | 3305 |
| LN | 07 | STO 3 | 3303 | 0 | 00 |
| 1 | 01 | 0 | 00 | $g \mathrm{x} \neq \mathrm{y}$ | 3521 |
| RCL 2 | 3402 | $g \mathrm{x} \neq \mathrm{y}$ | 3521 | 0 | 00 |
| + | 61 | 0 | 00 | RTN | 24 |
| f | 31 | RTN | 24 | B | 12 |
| LN | 07 | B | 12 | RCL 4 | 3404 |
| $\div$ | 81 | RCL 4 | 3404 | RCL 3 | 3403 |
| STO 1 | 3301 | RCL 5 | 3405 | RCL 7 | 3407 |
| RTN | 24 | RCL 6 | 3406 | X | 71 |
| LBL | 23 | x | 71 | - | 51 |
| B | 12 | - | 51 | RCL 6 | 3406 |
| EEX | 43 | RCL 7 | 3407 | $\div$ | 81 |
| 2 | 02 | $\div$ | 81 | STO 5 | 3305 |
| $\div$ | 81 | STO 3 | 3303 | RTN | 24 |
| 0 | 00 | RTN | 24 | g NOP | 3501 |
| $\mathrm{g} x \neq \mathrm{y}$ | 3521 | LBL | 23 |  |  |
| - | 51 | D | 14 |  |  |
| STO 2 | 3302 | STO 4 | 3304 |  |  |
| 1 | 01 | 0 | 00 |  |  |
| RCL 2 | 3402 | $g \mathrm{x} \neq \mathrm{y}$ | 3521 |  |  |


| $\mathbf{R}_{\mathbf{1}} \mathrm{n}$ | $\mathbf{R}_{\mathbf{4}}$ PV | $\mathbf{R}_{\mathbf{7}}\left[1-(1+\mathrm{i})^{-\mathrm{n}}\right] / \mathrm{i}$ |
| :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}} \mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ BAL | $\mathbf{R}_{\mathbf{8}}$ |
| $\mathbf{R}_{\mathbf{3}}$ PMT | $\mathbf{R}_{\mathbf{6}}(\mathbf{1}+\mathrm{i})^{-n}$ | $\mathbf{R}_{\mathbf{9}}$ Used |

## DIRECT REDUCTION LOAN WITH BALLOON PAYMENT SOLVE FOR i

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| STO 1 | 3301 | RCL 2 | 3402 | RCL 3 | 3403 |
| RTN | 24 | 1 | 01 | $\div$ | 81 |
| LBL | 23 | + | 61 | RCL 6 | 3406 |
| C | 13 | STO 6 | 3306 | $\div$ | 81 |
| STO 3 | 3303 | RCL 1 | 3401 | - | 51 |
| RTN | 24 | g | 35 | $\div$ | 81 |
| LBL | 23 | $\mathrm{y}^{\mathrm{x}}$ | 05 | STO | 33 |
| D | 14 | STO 7 | 3307 | + | 61 |
| STO 4 | 3304 | - | 51 | 2 | 02 |
| RTN | 24 | g LST X | 3500 | g | 35 |
| LBL | 23 | RCL 4 | 3404 | ABS | 06 |
| E | 15 | x | 71 | EEX | 43 |
| STO 5 | 3305 | RCL 5 | 3405 | CHS | 42 |
| RTN | 24 | - | 51 | 6 | 06 |
| LBL | 23 | RCL 3 | 3403 | $g x \leqslant y$ | 3522 |
| B | 12 | $\div$ | 81 | GTO | 22 |
| RCL 1 | 3401 | RCL 2 | 3402 | 1 | 01 |
| RCL 3 | 3403 | x | 71 | RCL 2 | 3402 |
| x | 71 | + | 61 | EEX | 43 |
| RCL 4 | 3404 | RCL 1 | 3401 | 2 | 02 |
| - | 51 | RCL 6 | 3406 | X | 71 |
| RCL 5 | 3405 | $\div$ | 81 | R/S | 84 |
| + | 61 | RCL 2 | 3402 | g NOP | 3501 |
| RCL 1 | 3401 | g | 35 | g NOP | 3501 |
| $\div$ | 81 | 1/x | 04 | g NOP | 3501 |
| RCL 4 | 3404 | + | 61 | g NOP | 3501 |
| $\div$ | 81 | RCL 7 | 3407 | g NOP | 3501 |
| STO 2 | 3302 | RCL 2 | 3402 | g NOP | 3501 |
| 0 | 00 | $\div$ | 81 | g NOP | 3501 |
| $\mathrm{g} \mathrm{x}=\mathrm{y}$ | 3523 | - | 51 | g NOP | 3501 |
| RTN | 24 | RCL 1 | 3401 |  |  |
| g NOP | 3501 | RCL 2 | 3402 |  |  |
| LBL | 23 | x | 71 |  |  |
| 1 | 01 | RCL 5 | 3405 |  |  |
| 1 | 01 | $\times$ | 71 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | n | $\mathbf{R}_{\mathbf{4}}$ | PV | $\mathbf{R}_{\mathbf{7}}$ | $(1+\mathrm{i} / \mathbf{1 0 0})^{\mathrm{n}}$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ | BAL | $\mathbf{R}_{\mathbf{8}}$ |  |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ | $(1+\mathrm{i} / 100)$ | $\mathbf{R}_{\mathbf{9}}$ | Used |

## SINKING FUND

SOLVE FOR n, PMT or FV

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| LBL | 23 | 0 | 00 | - | 51 |
| A | 11 | $\mathrm{g} x \neq y$ | 3521 | x | 71 |
| STO 1 | 3301 | 0 | 00 | STO 5 | 3305 |
| 0 | 00 | RTN | 24 | RTN | 24 |
| $g x \neq y$ | 3521 | RCL 5 | 3405 | LBL | 23 |
| 0 | 00 | RCL 2 | 3402 | D | 14 |
| RTN | 24 | x | 71 | 0 | 00 |
| RCL 5 | 3405 | 1 | 01 | $\div$ | 81 |
| RCL 3 | 3403 | RCL 2 | 3402 | RTN | 24 |
| $\div$ | 81 | + | 61 | g NOP | 3501 |
| RCL 2 | 3402 | RCL 1 | 3401 | g NOP | 3501 |
| x | 71 | g | 35 | g NOP | 3501 |
| 1 | 01 | $\mathrm{y}^{\mathrm{x}}$ | 05 | g NOP | 3501 |
| + | 61 | 1 | 01 | g NOP | 3501 |
| f | 31 | - | 51 | g NOP | 3501 |
| LN | 07 | $\div$ | 81 | g NOP | 3501 |
| 1 | 01 | STO 3 | 3303 | g NOP | 3501 |
| RCL 2 | 3402 | RTN | 24 | g NOP | 3501 |
| + | 61 | LBL | 23 | g NOP | 3501 |
| f | 31 | E | 15 | g NOP | 3501 |
| LN | 07 | STO 5 | 3305 | g NOP | 3501 |
| $\div$ | 81 | 0 | 00 | g NOP | 3501 |
| STO 1 | 3301 | $g \mathrm{x} \neq \mathrm{y}$ | 3521 | g NOP | 3501 |
| RTN | 24 | 0 | 00 | g NOP | 3501 |
| LBL | 23 | RTN | 24 | g NOP | 3501 |
| B | 12 | RCL 3 | 3403 | g NOP | 3501 |
| EEX | 43 | RCL 2 | 3402 | g NOP | 3501 |
| 2 | 02 | $\div$ | 81 | g NOP | 3501 |
| $\div$ | 81 | 1 | 01 | g NOP | 3501 |
| STO 2 | 3302 | RCL 2 | 3402 | g NOP | 3501 |
| 0 | 00 | + | 61 |  |  |
| RTN | 24 | RCL 1 | 3401 |  |  |
| LBL | 23 |  | 35 |  |  |
| C | 13 | $\mathrm{y}^{\mathrm{x}}$ | 05 |  |  |
| STO 3 | 3303 | 1 | 01 |  |  |


| $\mathrm{R}_{1} \mathrm{n}$ | $\mathrm{R}_{4}$ | $\mathrm{R}_{7}$ |
| :---: | :---: | :---: |
| $\mathrm{R}_{\mathbf{2}} \mathrm{i} / 100$ | $\mathrm{R}_{5} \mathrm{FV}$ | $\mathrm{R}_{8}$ |
| $\mathbf{R}_{3}$ PMT | $\mathbf{R}_{6}$ | $\mathbf{R g}_{9}$ Used |

SINKING FUND SOLVE FOR i

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| LBL | 23 | STO 2 | 3302 | x | 71 |
| A | 11 | LBL | 23 | $\div$ | 81 |
| STO 1 | 3301 | 1 | 01 | STO | 33 |
| RTN | 24 | RCL 2 | 3402 | - | 51 |
| LBL | 23 | 1 | 01 | 2 | 02 |
| C | 13 | + | 61 | g | 35 |
| STO 3 | 3303 | STO 6 | 3306 | ABS | 06 |
| RTN | 24 | RCL 1 | 3401 | EEX | 43 |
| LBL | 23 | g | 35 | 6 | 06 |
| E | 15 | $y^{x}$ | 05 | CHS | 42 |
| STO 5 | 3305 | STO 7 | 3307 | $\mathrm{g} \mathrm{x} \leqslant \mathrm{y}$ | 3522 |
| RTN | 24 | 1 | 01 | GTO | 22 |
| LBL | 23 | - | 51 | 1 | 01 |
| B | 12 | RCL 2 | 3402 | RCL 2 | 3402 |
| RCL 5 | 3405 | $\div$ | 81 | EEX | 43 |
| RCL 3 | 3403 | RCL 3 | 3403 | 2 | 02 |
| $\div$ | 81 | x | 71 | x | 71 |
| STO 6 | 3306 | RCL 5 | 3405 | RTN | 24 |
| RCL 1 | 3401 | - | 51 | LBL | 23 |
| - | 51 | RCL 1 | 3401 | D | 14 |
| g LST X | 3500 | RCL 2 | 3402 | 0 | 00 |
| 1 | 01 | x | 71 | $\div$ | 81 |
| - | 51 | RCL 7 | 3407 | RTN | 24 |
| $\uparrow$ | 41 | RCL 6 | 3406 | g NOP | 3501 |
| x | 71 | $\div$ | 81 | g NOP | 3501 |
| RCL 6 | 3406 | x | 71 | g NOP | 3501 |
| + | 61 | 1 | 01 | g NOP | 3501 |
| $\div$ | 81 | + | 61 | g NOP | 3501 |
| 2 | 02 | RCL 7 | 3407 | g NOP | 3501 |
| x | 71 | - | 51 | g NOP | 3501 |
| 0 | 00 | RCL 2 | 3402 |  |  |
| $g \mathrm{x}=\mathrm{y}$ | 3523 | $\uparrow$ | 41 |  |  |
| RTN | 24 | x | 71 |  |  |
| g NOP | 3501 | $\div$ | 81 |  |  |
| $g \mathrm{R} \downarrow$ | 3508 | RCL 3 | 3403 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | n | $\mathbf{R}_{\mathbf{4}}$ | $\mathbf{R}_{\mathbf{7}}$ | $(1+\mathrm{i} / 100)^{\mathrm{n}}$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | i/100 | $\mathbf{R}_{\mathbf{5}}$ | FV | $\mathbf{R}_{\mathbf{8}}$ |  |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ | Used, $(1+\mathrm{i} / 100)$ | $\mathbf{R}_{\mathbf{9}}$ | Used |

PERIODIC SAVINGS, ANNUITY DUE SOLVE FOR n , PMT or FV

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| LBL | 23 | RTN | 24 | + | 61 |
| A | 11 | LBL | 23 | STO 6 | 3306 |
| STO 1 | 3301 | C | 13 | RCL 1 | 3401 |
| 0 | 00 | STO 3 | 3303 | 1 | 01 |
| $\mathrm{g} x \neq y$ | 3521 | 0 | 00 | + | 61 |
| 0 | 00 | $\mathrm{g} x \neq y$ | 3521 | g | 35 |
| RTN | 24 | 0 | 00 | $\mathrm{y}^{\mathrm{x}}$ | 05 |
| RCL 5 | 3405 | RTN | 24 | RCL 6 | 3406 |
| RCL 3 | 3403 | 1 | 01 | - | 51 |
| $\div$ | 81 | RCL 2 | 3402 | RCL 2 | 3402 |
| RCL 2 | 3402 | + | 61 | $\div$ | 81 |
| x | 71 | STO 6 | 3306 | RCL 3 | 3403 |
| g LST X | 3500 | RCL 1 | 3401 | x | 71 |
| 1 | 01 | 1 | 01 | STO 5 | 3305 |
| + | 61 | + | 61 | RTN | 24 |
| $\uparrow$ | 41 | g | 35 | LBL | 23 |
| $\mathrm{g} \mathrm{R} \downarrow$ | 3508 | $\mathrm{y}^{\mathrm{x}}$ | 05 | D | 14 |
| + | 61 | RCL 6 | 3406 | 0 | 00 |
| f | 31 | - | 51 | $\div$ | 81 |
| LN | 07 | RCL 2 | 3402 | RTN | 24 |
| $g \mathrm{R} \uparrow$ | 3509 | $\div$ | 81 | g NOP | 3501 |
| f | 31 | RCL 5 | 3405 | g NOP | 3501 |
| LN | 07 | $\mathrm{g} \times \underset{\mathrm{y}}{ }$ | 3507 | g NOP | 3501 |
| $\div$ | 81 | $\div$ | 81 | g NOP | 3501 |
| 1 | 01 | STO 3 | 3303 | g NOP | 3501 |
| - | 51 | RTN | 24 | g NOP | 3501 |
| STO 1 | 3301 | LBL | 23 | g NOP | 3501 |
| RTN | 24 | E | 15 | g NOP | 3501 |
| LBL | 23 | STO 5 | 3305 | g NOP | 3501 |
| B | 12 | 0 | 00 | g NOP | 3501 |
| EEX | 43 | $g \mathrm{x} \neq \mathrm{y}$ | 3521 |  |  |
| 2 | 02 | 0 | 00 |  |  |
| $\div$ | 81 | RTN | 24 |  |  |
| STO 2 | 3302 | 1 | 01 |  |  |
| 0 | 00 | RCL 2 | 3402 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | $\mathbf{n}$ | $\mathbf{R}_{\mathbf{4}}$ |  |
| :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ | FV |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ | $(1+\mathrm{i} / 100)$ |

## PERIODIC SAVINGS, ANNUITY DUE

 SOLVE FOR i| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| STO 1 | 3301 | g NOP | 3501 | - | 51 |
| RTN | 24 | LBL | 23 | RCL 2 | 3402 |
| LBL | 23 | 1 | 01 | $\uparrow$ | 41 |
| C | 13 | RCL 2 | 3402 | x | 71 |
| STO 3 | 3303 | 1 | 01 | $\div$ | 81 |
| RTN | 24 | + | 61 | RCL 3 | 3403 |
| LBL | 23 | STO 6 | 3306 | x | 71 |
| D | 14 | RCL 1 | 3401 | $\div$ | 81 |
| 0 | 00 | g | 35 | STO | 33 |
| $\div$ | 81 | $y^{x}$ | 05 | - | 51 |
| RTN | 24 | STO 7 | 3307 | 2 | 02 |
| LBL | 23 | RCL 6 | 3406 | g | 35 |
| E | 15 | x | 71 | ABS | 06 |
| STO 5 | 3305 | g LST X | 3500 | EEX | 43 |
| RTN | 24 | - | 51 | 6 | 06 |
| LBL | 23 | RCL 2 | 3402 | CHS | 42 |
| B | 12 | $\div$ | 81 | $\mathrm{g} x \leqslant y$ | 3522 |
| RCL 5 | 3405 | RCL 3 | 3403 | GTO | 22 |
| RCL 3 | 3403 | x | 71 | 1 | 01 |
| $\div$ | 81 | RCL 5 | 3405 | RCL 2 | 3402 |
| STO 6 | 3306 | - | 51 | EEX | 43 |
| RCL 1 | 3401 | RCL 1 | 3401 | 2 | 02 |
| - | 51 | 1 | 01 | x | 71 |
| 2 | 02 | + | 61 | R/S | 84 |
| x | 71 | RCL 7 | 3407 | g NOP | 3501 |
| RCL 1 | 3401 | x | 71 | g NOP | 3501 |
| $\uparrow$ | 41 | 1 | 01 | g NOP | 3501 |
| x | 71 | - | 51 | g NOP | 3501 |
| RCL 6 | 3406 | RCL 2 | 3402 | g NOP | 3501 |
| + | 61 | x | 71 | g NOP | 3501 |
| $\div$ | 81 | RCL 7 | 3407 |  |  |
| STO 2 | 3302 | RCL 6 | 3406 |  |  |
| 0 | 00 | $\times$ | 71 |  |  |
| $\mathrm{g} \mathrm{x}=\mathrm{y}$ | 3523 | g LST X | 3500 |  |  |
| RTN | 24 | - | 51 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | n | $\mathbf{R}_{\mathbf{4}}$ |  | $\mathbf{R}_{\mathbf{7}}$ | $(1+\mathrm{i} / 100)^{\mathrm{n}}$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ | FV | $\mathbf{R}_{\mathbf{8}}$ |  |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ | $\mathbf{1}+\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{9}}$ | Used |

## PRESENT VALUE, ANNUITY DUE SOLVE FOR n, PMT, or PV

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | 00 | 2 | 02 | $\mathrm{g} \mathrm{x} \neq \mathrm{y}$ | 3521 |
| $\div$ | 81 | $\div$ | 81 | 0 | 00 |
| LBL | 23 | STO 2 | 3302 | RTN | 24 |
| A | 11 | 0 | 00 | RCL 3 | 3403 |
| STO 1 | 3301 | RTN | 24 | 1 | 01 |
| 0 | 00 | LBL | 23 | RCL 2 | 3402 |
| $g \mathrm{x} \neq \mathrm{y}$ | 3521 | C | 13 | + | 61 |
| 0 | 00 | STO 3 | 3303 | x | 71 |
| RTN | 24 | 0 | 00 | g LST X | 3500 |
| 1 | 01 | $g \mathrm{x} \neq \mathrm{y}$ | 3521 | RCL 1 | 3401 |
| RCL 2 | 3402 | 0 | 00 | g | 35 |
| + | 61 | RTN | 24 | $y^{x}$ | 05 |
| g | 35 | RCL 4 | 3404 | $g$ | 35 |
| 1/x | 04 | 1 | 01 | 1/x | 04 |
| f | 31 | RCL 2 | 3402 | CHS | 42 |
| LN | 07 | + | 61 | 1 | 01 |
| g LST X | 3500 | $\div$ | 81 | + | 61 |
| RCL 4 | 3404 | g LST X | 3500 | RCL 2 | 3402 |
| x | 71 | RCL 1 | 3401 | $\div$ | 81 |
| RCL 2 | 3402 | g | 35 | $\times$ | 71 |
| x | 71 | $y^{x}$ | 05 | STO 4 | 3304 |
| RCL 3 | 3403 |  | 35 | RTN | 24 |
| $\div$ | 81 | 1/x | 04 | g NOP | 3501 |
| CHS | 42 | CHS | 42 | g NOP | 3501 |
| 1 | 01 | 1 | 01 | g NOP | 3501 |
| + | 61 | + | 61 | g NOP | 3501 |
| f | 31 | RCL 2 | 3402 | g NOP | 3501 |
| LN | 07 | $\div$ | 81 | g NOP | 3501 |
| $g \times \stackrel{\square}{\square}$ | 3507 | $\div$ | 81 | g NOP | 3501 |
| $\div$ | 81 | STO 3 | 3303 | g NOP | 3501 |
| STO 1 | 3301 | RTN | 24 |  |  |
| RTN | 24 | LBL | 23 |  |  |
| LBL | 23 | D | 14 |  |  |
| B | 12 | STO 4 | 3304 |  |  |
| EEX | 43 | 0 | 00 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | n | $\mathbf{R}_{\mathbf{4}}$ | PV |
| :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | i/100 | $\mathbf{R}_{\mathbf{5}}$ | $\mathbf{R}_{\mathbf{7}}$ |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ | $\mathbf{R}_{\mathbf{8}}$ |

## PRESENT VALUE, ANNUITY DUE SOLVE FOR i

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | 00 | 0 | 00 | + | 61 |
| $\div$ | 81 | $\mathrm{g} x=y$ | 3523 | 2 | 02 |
| LBL | 23 | 0 | 00 | g | 35 |
| A | 11 | RTN | 24 | ABS | 06 |
| STO 1 | 3301 | LBL | 23 | EEX | 43 |
| RTN | 24 | 1 | 01 | CHS | 42 |
| LBL | 23 | RCL 2 | 3402 | 6 | 06 |
| C | 13 | 1 | 01 | $g \mathrm{x} \leqslant \mathrm{y}$ | 3522 |
| STO 3 | 3303 | + | 61 | GTO | 22 |
| RTN | 24 | STO 6 | 3306 | 1 | 01 |
| LBL | 23 | RCL 1 | 3401 | RCL 2 | 3402 |
| D | 14 | g | 35 | EEX | 43 |
| STO 4 | 3304 | $\mathrm{y}^{\mathrm{x}}$ | 05 | 2 | 02 |
| RTN | 24 | STO 7 | 3307 | x | 71 |
| LBL | 23 | RCL 4 | 3404 | R/S | 84 |
| B | 12 | RCL 2 | 3402 | g NOP | 3501 |
| RCL 3 | 3403 | x | 71 | g NOP | 3501 |
| RCL 4 | 3404 | RCL 3 | 3403 | g NOP | 3501 |
| RCL 3 | 3403 | $\div$ | 81 | g NOP | 3501 |
| - | 51 | RCL 6 | 3406 | g NOP | 3501 |
| $\div$ | 81 | - | 51 | g NOP | 3501 |
| g LST X | 3500 | X | 71 | g NOP | 3501 |
| RCL 3 | 3403 | RCL 6 | 3406 | g NOP | 3501 |
| x | 71 | + | 61 | g NOP | 3501 |
| RCL 1 | 3401 | RCL 2 | 3402 | g NOP | 3501 |
| $\uparrow$ | 41 | X | 71 | g NOP | 3501 |
| x | 71 | g LST X | 3500 | g NOP | 3501 |
| x | 71 | RCL 1 | 3401 | g NOP | 3501 |
| RCL 4 | 3404 | X | 71 | g NOP | 3501 |
| $\uparrow$ | 41 | RCL 7 | 3407 | g NOP | 3501 |
| x | 71 | - | 51 |  |  |
| $g x \neq y$ | 3507 | 1 | 01 |  |  |
| $\div$ | 81 | + | 61 |  |  |
| - | 51 | $\div$ | 81 |  |  |
| STO 2 | 3302 | STO | 33 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | n | $\mathbf{R}_{\mathbf{4}}$ | PV | $\mathbf{R}_{\mathbf{7}}$ | $(1+\mathrm{i} / 100)^{\mathbf{n}}$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ |  | $\mathbf{R}_{\mathbf{8}}$ |  |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ | $(1+\mathrm{i} / 100)$ | $\mathbf{R}_{\mathbf{9}}$ | Used |

PRESENT VALUE, ANNUITY DUE WITH BALLOON PAYMENT SOLVE FOR n, PMT, PV, or BAL

| KEYS | CODE |
| :--- | ---: |
| STO 1 | 3301 |
| 0 | 00 |
| g x $=\mathrm{y}$ | 3521 |
| 0 | 00 |
| RTN | 24 |
| RCL 5 | 3405 |
| RCL 6 | 3406 |
| RCL 3 | 3403 |
| x | 71 |
| RCL 2 | 3402 |
| $\div$ | 81 |
| - | 51 |
| RCL 4 | 3404 |
| g LST X | 3500 |
| - | 51 |
| $\div$ | 81 |
| f | 31 |
| LN | 07 |
| RCL 6 | 3406 |
| f | 31 |
| LN | 07 |
| $\div$ | 81 |
| STO 1 | 3301 |
| RTN | 24 |
| LBL | 23 |
| B | 12 |
| EEX | 43 |
| 2 | 02 |
| $\div$ | 81 |
| 0 | 00 |
| gx $\neq y$ | 3521 |
| - | 51 |
| STO 2 | 3302 |
| 1 | 01 |
| RCL 2 | 3402 |
|  |  |


| KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: |
| 1 | 01 | STO 3 | 3303 |
| + | 61 | RTN | 24 |
| STO 6 | 3306 | LBL | 23 |
| RCL 1 | 3401 | D | 14 |
| CHS | 42 | STO 4 | 3304 |
| g | 35 | 0 | 00 |
| $\mathrm{y}^{\mathrm{x}}$ | 05 | $g \mathrm{x} \neq \mathrm{y}$ | 3521 |
| STO 8 | 3308 | 0 | 00 |
| - | 51 | RTN | 24 |
| RCL 2 | 3402 | B | 12 |
| $\div$ | 81 | $\mathrm{g} \mathrm{R} \downarrow$ | 3508 |
| RCL 6 | 3406 | + | 61 |
| x | 71 | STO 4 | 3304 |
| STO 7 | 3307 | RTN | 24 |
| RCL 3 | 3403 | LBL | 23 |
| x | 71 | E | 15 |
| RCL 8 | 3408 | STO 5 | 3305 |
| RCL 5 | 3405 | 0 | 00 |
| x | 71 | $\mathrm{g} x \neq y$ | 3521 |
| 0 | 00 | 0 | 00 |
| RTN | 24 | RTN | 24 |
| LBL | 23 | B | 12 |
| C | 13 | RCL 4 | 3404 |
| STO 3 | 3303 | g R $\uparrow$ | 3509 |
| 0 | 00 | - | 51 |
| $g x \neq y$ | 3521 | RCL 8 | 3408 |
| 0 | 00 | $\div$ | 81 |
| RTN | 24 | STO 5 | 3305 |
| B | 12 | RTN | 24 |
| $\mathrm{g} \times \underset{y}{ }$ | 3507 | g NOP | 3501 |
| CHS | 42 |  |  |
| RCL 4 | 3404 |  |  |
| + | 61 |  |  |
| RCL 7 | 3407 |  |  |
| $\div$ | 81 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | n | $\mathbf{R}_{\mathbf{4}}$ | PV | $\mathbf{R}_{\mathbf{7}}$ | Q |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ | BAL | $\mathbf{R}_{\mathbf{8}}$ | $(1+\mathrm{i} / 100)^{-n}$ |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ | $\mathbf{1}+\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{9}}$ | Used |

PRESENT VALUE, ANNUITY DUE WITH BALLOON PAYMENT SOLVE FOR $\mathbf{i}$

| KEYS | CODE |
| :--- | ---: |
| STO 1 | 3301 |
| RTN | 24 |
| LBL | 23 |
| C | 13 |
| STO 3 | 3303 |
| RTN | 24 |
| LBL | 23 |
| D | 14 |
| STO 4 | 3304 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| STO 5 | 3305 |
| RTN | 24 |
| LBL | 23 |
| B | 12 |
| RCL 1 | 3401 |
| RCL 3 | 3403 |
| x | 71 |
| RCL 4 | 3404 |
| - | 51 |
| RCL 5 | 3405 |
| + | 61 |
| RCL 4 | 3404 |
| RCL 3 | 3403 |
| - | 51 |
| $\div$ | 81 |
| RCL 1 | 3401 |
| $\div$ | 81 |
| STO 2 | 3302 |
| 0 | 00 |
| gx=y | 3523 |
| RTN | 24 |
| LBL | 23 |
| 1 | 01 |
|  |  |


| KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: |
| RCL 2 | 3402 | RCL 5 | 3405 |
| 1 | 01 | RCL 2 | 3402 |
| + | 61 | x | 71 |
| STO 6 | 3306 | RCL 1 | 3401 |
| RCL 1 | 3401 | x | 71 |
| g | 35 | RCL 6 | 3406 |
| $y^{x}$ | 05 | $\div$ | 81 |
| STO 7 | 3307 | RCL 3 | 3403 |
| RCL 4 | 3404 | $\div$ | 81 |
| x | 71 | - | 51 |
| RCL 5 | 3405 | $\div$ | 81 |
| - | 51 | STO | 33 |
| RCL 3 | 3403 | + | 61 |
| $\div$ | 81 | 2 | 02 |
| RCL 2 | 3402 | g | 35 |
| x | 71 | ABS | 06 |
| RCL 7 | 3407 | EEX | 43 |
| - | 51 | CHS | 42 |
| RCL 7 | 3407 | 6 | 06 |
| RCL 2 | 3402 | $g \mathrm{x} \leqslant \mathrm{y}$ | 3522 |
| x | 71 | GTO | 22 |
| - | 51 | 1 | 01 |
| RCL 6 | 3406 | RCL 2 | 3402 |
| + | 61 | EEX | 43 |
| RCL 1 | 3401 | 2 | 02 |
| 1 | 01 | x | 71 |
| - | 51 | R/S | 84 |
| RCL 7 | 3407 | g NOP | 3501 |
| RCL 2 | 3402 | g NOP | 3501 |
| $\div$ | 81 | g NOP | 3501 |
| - | 51 |  |  |
| RCL 6 | 3406 |  |  |
| RCL 2 | 3402 |  |  |
| $\div$ | 81 |  |  |
| + | 61 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | $\mathbf{n}$ | $\mathbf{R}_{\mathbf{4}}$ | PV | $\mathbf{R}_{\mathbf{7}}$ | $(1+\mathrm{i} / 100)^{\mathrm{n}}$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ | BAL | $\mathbf{R}_{\mathbf{8}}$ |  |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ | $(1+\mathrm{i} / 100)$ | $\mathbf{R}_{\mathbf{9}}$ | Used |

## SAVINGS-COMPOUNDING PERIODS DIFFERENT FROM PAYMENT PERIODS

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| STO 3 | 3303 | D | 14 | 2 | 02 |
| 0 | 00 | RCL 3 | 3403 | LBL | 23 |
| $\mathrm{g} \mathrm{x}=\mathrm{y}$ | 3521 | X | 71 | 1 | 01 |
| RTN | 24 | STO 5 | 3305 | X | 71 |
| RTN | 24 | RTN | 24 | RCL 2 | 3402 |
| D | 14 | LBL | 23 | STO 7 | 3307 |
| RCL 5 | 3405 | B | 12 | 2 | 02 |
| $\mathrm{g} \mathrm{x} \overrightarrow{\mathrm{F}} \mathrm{y}$ | 3507 | EEX | 43 | $\div$ | 81 |
| $\div$ | 81 | 2 | 02 | RCL 6 | 3406 |
| STO 3 | 3303 | $\div$ | 81 | 1 | 01 |
| RTN | 24 | STO 2 | 3302 | + | 61 |
| LBL | 23 | 0 | 00 | x | 71 |
| A | 11 | RTN | 24 | RCL 6 | 3406 |
| STO 1 | 3301 | LBL | 23 | + | 61 |
| 0 | 00 | D | 14 | LBL | 23 |
| RTN | 24 | RCL 6 | 3406 | 2 | 02 |
| LBL | 23 | g | 35 | $\mathrm{g} \times \underset{y}{ } \mathrm{y}$ | 3507 |
| A | 11 | 1/x | 04 | RCL 7 | 3407 |
| $\mathrm{f}^{-1}$ | 32 | RCL 1 | 3401 | 1 | 01 |
| SF 1 | 51 | $\mathrm{f}^{-1}$ | 32 | + | 61 |
| STO 6 | 3306 | TF 1 | 61 | $g \times \overrightarrow{ }$ ¢ | 3507 |
| 1 | 01 | GTO | 22 | g | 35 |
| - | 51 | 1 | 01 | $\mathrm{y}^{\mathrm{x}}$ | 05 |
| 0 | 00 | RCL 2 | 3402 | 1 | 01 |
| $\mathrm{gx}>\mathrm{y}$ | 3524 | 1 | 01 | - | 51 |
| $f$ | 31 | + | 61 | x | 71 |
| SF 1 | 51 | $\mathrm{g} R \uparrow$ | 3509 | RCL 7 | 3407 |
| RTN | 24 | g | 35 | $\div$ | 81 |
| LBL | 23 | $\mathrm{y}^{\mathrm{x}}$ | 05 | RTN | 24 |
| E | 15 | 1 | 01 | g NOP | 3501 |
| STO 5 | 3305 | - | 51 |  |  |
| 0 | 00 | STO 7 | 3307 |  |  |
| $\mathrm{g} x \neq y$ | 3521 | 1 | 01 |  |  |
| RTN | 24 | + | 61 |  |  |
| RTN | 24 | GTO | 22 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ \#PAY | $\mathbf{R}_{\mathbf{4}}$ | $\mathbf{R}_{\mathbf{7}}$ Q |
| :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ i/100 | $\mathbf{R}_{\mathbf{5}}$ FV | $\mathbf{R}_{\mathbf{8}}$ |
| $\mathbf{R}_{\mathbf{3}}$ PMT | $\mathbf{R}_{\mathbf{6}}$ P/C | $\mathbf{R}_{\mathbf{9}}$ Used |

## NOMINAL TO EFFECTIVE/EFFECTIVE TO NOMINAL RATE CONVERSION

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| STO 1 | 3301 | RTN | 24 | EEX | 43 |
| 0 | 00 | RTN | 24 | 2 | 02 |
| RTN | 24 | RCL 2 | 3402 | x | 71 |
| LBL | 23 | RCL 1 | 3401 | STO 4 | 3304 |
| B | 12 | EEX | 43 | RTN | 24 |
| STO 2 | 3302 | 2 | 02 | LBL | 23 |
| 0 | 00 | X | 71 | E | 15 |
| gx ¢ y | 3521 | $\div$ | 81 | STO 5 | 3305 |
| RTN | 24 | 1 | 01 | 0 | 00 |
| RTN | 24 | + | 61 | $\mathrm{g} x \neq y$ | 3521 |
| RCL 3 | 3403 | RCL 1 | 3401 | RTN | 24 |
| EEX | 43 | g | 35 | RTN | 24 |
| 2 | 02 | $y^{x}$ | 05 | RCL 4 | 3404 |
| $\div$ | 81 | 1 | 01 | EEX | 43 |
| 1 | 01 | - | 51 | 2 | 02 |
| + | 61 | EEX | 43 | $\div$ | 81 |
| RCL 1 | 3401 | 2 | 02 | $\mathrm{f}^{-1}$ | 32 |
|  | 35 | x | 71 | LN | 07 |
| $1 / x$ | 04 | STO 3 | 3303 | 1 | 01 |
| g | 35 | RTN | 24 | - | 51 |
| $y^{x}$ | 05 | LBL | 23 | EEX | 43 |
| 1 | 01 | D | 14 | 2 | 02 |
| - | 51 | STO 4 | 3304 | x | 71 |
| RCL 1 | 3401 | 0 | 00 | STO 5 | 3305 |
| x | 71 | $g \mathrm{x} \neq \mathrm{y}$ | 3521 | RTN | 24 |
| EEX | 43 | RTN | 24 | g NOP | 3501 |
| 2 | 02 | RTN | 24 | g NOP | 3501 |
| x | 71 | RCL 5 | 3405 | g NOP | 3501 |
| STO 2 | 3302 | EEX | 43 | g NOP | 3501 |
| RTN | 24 | 2 | 02 | g NOP | 3501 |
| LBL | 23 | $\div$ | 81 |  |  |
| C | 13 | 1 | 01 |  |  |
| STO 3 | 3303 | + | 61 |  |  |
| 0 | 00 | f | 31 |  |  |
| $g \mathrm{x} \neq \mathrm{y}$ | 3521 | LN | 07 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | C/YR | $\mathbf{R}_{\mathbf{4}}$ | NOM | $\mathbf{R}_{\mathbf{7}}$ |
| :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | NOM | $\mathbf{R}_{\mathbf{5}}$ | EFF Continuous | $\mathbf{R}_{\mathbf{8}}$ |
| $\mathbf{R}_{\mathbf{3}}$ | EFF | $\mathbf{R}_{\mathbf{6}}$ |  |  |

## DIRECT REDUCTION LOAN ACCUMULATED INTEREST/REMAINING BALANCE

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| LBL | 23 | 1 | 01 | + | 61 |
| A | 11 | + | 61 | RCL 6 | 3406 |
| RCL 1 | 3401 | RCL 1 | 3401 | $\div$ | 81 |
| STO 8 | 3308 | CHS | 42 | RCL 5 | 3405 |
| $\mathrm{g} \times \overrightarrow{\mathrm{r}} \mathrm{y}$ | 3507 | g | 35 | - | 51 |
| STO 1 | 3301 | $y^{x}$ | 05 | CHS | 42 |
| RTN | 24 | STO 6 | 3306 | RCL 1 | 3401 |
| LBL | 23 | 1 | 01 | RCL 8 | 3408 |
| B | 12 | - | 51 | - | 51 |
| EEX | 43 | RCL 2 | 3402 | 1 | 01 |
| 2 | 02 | $\div$ | 81 | + | 61 |
| $\div$ | 81 | RCL 3 | 3403 | RCL 3 | 3403 |
| STO 2 | 3302 | x | 71 | x | 71 |
| RTN | 24 | RCL 4 | 3404 | + | 61 |
| LBL | 23 | + | 61 | RTN | 24 |
| C | 13 | RCL 6 | 3406 | LBL | 23 |
| STO 3 | 3303 | $\div$ | 81 | E | 15 |
| RTN | 24 | STO 5 | 3305 | RCL 5 | 3405 |
| LBL | 23 | 1 | 01 | RTN | 24 |
| D | 14 | RCL 2 | 3402 | g NOP | 3501 |
| STO 4 | 3304 | + | 61 | g NOP | 3501 |
| RTN | 24 | RCL 8 | 3408 | g NOP | 3501 |
| LBL | 23 | 1 | 01 | g NOP | 3501 |
| E | 15 | - | 51 | g NOP | 3501 |
| RCL 1 | 3401 | CHS | 42 | g NOP | 3501 |
| RCL 8 | 3408 | g | 35 | g NOP | 3501 |
| $\mathrm{gx} \leqslant \mathrm{y}$ | 3522 | $y^{x}$ | 05 | g NOP | 3501 |
| GTO | 22 | STO 6 | 3306 | g NOP | 3501 |
| 1 | 01 | 1 | 01 | g NOP | 3501 |
| STO 1 | 3301 | - | 51 | g NOP | 3501 |
| g R $\downarrow$ | 3508 | RCL 2 | 3402 |  |  |
| STO 8 | 3308 | $\div$ | 81 |  |  |
| LBL | 23 | RCL 3 | 3403 |  |  |
| 1 | 01 | x | 71 |  |  |
| RCL 2 | 3402 | RCL 4 | 3404 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | K | $\mathbf{R}_{\mathbf{4}}$ | PV | $\mathbf{R}_{\mathbf{7}}$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ | $\mathrm{BAL}_{\mathrm{k}}$ | $\mathbf{R}_{\mathbf{8}}$ | J |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ | $(1+\mathrm{i} / 100)^{-\mathrm{k}}$ | $\mathbf{R}_{\mathbf{9}}$ | Used |

## DIRECT REDUCTION LOAN AMORTIZATION SCHEDULE

| KEYS | CODE |
| :--- | ---: |
| LBL | 23 |
| A | 11 |
| STO 1 | 3301 |
| RTN | 24 |
| LBL | 23 |
| B | 12 |
| EEX | 43 |
| 2 | 02 |
| $\vdots$ | 81 |
| STO 2 | 3302 |
| g LST X | 3500 |
| x | 71 |
| RTN | 24 |
| LBL | 23 |
| C | 13 |
| STO 3 | 3303 |
| RTN | 24 |
| LBL | 23 |
| D | 14 |
| STO 4 | 3304 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| 1 | 01 |
| RCL 2 | 3402 |
| + | 61 |
| STO 8 | 3308 |
| RCL 1 | 3401 |
| CHS | 42 |
| g | 35 |
| y | 05 |
| STO 6 | 3306 |
| 1 | 01 |
| - | 51 |
| RCL 2 | 3402 |
|  |  |


| KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: |
| $\div$ | 81 | LBL | 23 |
| RCL 3 | 3403 | E | 15 |
| x | 71 | RCL 7 | 3407 |
| RCL 4 | 3404 | RTN | 24 |
| + | 61 | LBL | 23 |
| RCL 6 | 3406 | E | 15 |
| $\div$ | 81 | RCL 5 | 3405 |
| STO 5 | 3305 | RTN | 24 |
| RCL 8 | 3408 | LBL | 23 |
| RCL 1 | 3401 | E | 15 |
| 1 | 01 | RCL 1 | 3401 |
| - | 51 | RCL 3 | 3403 |
| CHS | 42 | x | 71 |
| g | 35 | RCL 4 | 3404 |
| $y^{x}$ | 05 | RCL 5 | 3405 |
| STO 6 | 3306 | - | 51 |
| 1 | 01 | - | 51 |
| - | 51 | RTN | 24 |
| RCL 2 | 3402 | LBL | 23 |
| $\div$ | 81 | E | 15 |
| RCL 3 | 3403 | RCL 1 | 3401 |
| x | 71 | 1 | 01 |
| RCL 4 | 3404 | + | 61 |
| + | 61 | STO 1 | 3301 |
| RCL 6 | 3406 | RTN | 24 |
| $\div$ | 81 | g NOP | 3501 |
| CHS | 42 | g NOP | 3501 |
| RCL 5 | 3405 | g NOP | 3501 |
| + | 61 | g NOP | 3501 |
| CHS | 42 | g NOP | 3501 |
| STO 7 | 3307 |  |  |
| RCL 3 | 3403 |  |  |
| $\mathrm{g} x \stackrel{\mathrm{~F}}{\mathrm{y}}$ | 3507 |  |  |
| - | 51 |  |  |
| RTN | 24 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | K | $\mathbf{R}_{\mathbf{4}}$ | PV | $\mathbf{R}_{\mathbf{7}}$ | PMT to PRIN |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ | BAL $_{\mathbf{k}}$ | $\mathbf{R}_{\mathbf{8}}$ | $(1+\mathrm{i})$ |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ | $(1+\mathrm{i})^{-\mathrm{K}}$ | $\mathbf{R}_{\mathbf{9}}$ |  |

## ADD-ON RATE INSTALLMENT LOAN (CARD 1)

| KEYS | CODE |
| :--- | ---: |
| LBL | 23 |
| A | 11 |
| STO 1 | 3301 |
| RTN | 24 |
| LBL | 23 |
| B | 12 |
| STO 6 | 3306 |
| 1 | 01 |
| 2 | 02 |
| x | 71 |
| 3 | 03 |
| 6 | 06 |
| 5 | 05 |
| $\vdots$ | 81 |
| STO 2 | 3302 |
| RCL 6 | 3406 |
| RTN | 24 |
| LBL | 23 |
| C | 13 |
| STO 3 | 3303 |
| RTN | 24 |
| LBL | 23 |
| D | 14 |
| STO 4 | 3304 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 1 | 3401 |
| RCL 2 | 3402 |
| + | 61 |
| 1 | 01 |
| 2 | 02 |
| $\div$ | 81 |
| RCL 3 | 3403 |
| x | 71 |
|  |  |
|  |  |


| KEYS | CODE |
| :--- | ---: |
| EEX | 43 |
| 2 | 02 |
| $\vdots$ | 81 |
| RCL 4 | 3404 |
| x | 71 |
| STO 6 | 3306 |
| RCL 4 | 3404 |
| + | 61 |
| RCL 1 | 3401 |
| $\div$ | 81 |
| STO 5 | 3305 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 6 | 3406 |
| RTN | 24 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |


| KEYS | CODE |
| :--- | ---: |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |


| $\mathbf{R}_{\mathbf{1}}$ | $\mathbf{N}$ | $\mathbf{R}_{\mathbf{4}}$ | AMT | $\mathbf{R}_{\mathbf{7}}$ |
| :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | ODD | $\mathbf{R}_{\mathbf{5}}$ | PMT | $\mathbf{R}_{\mathbf{8}}$ |
| $\mathbf{R}_{\mathbf{3}}$ | AIR | $\mathbf{R}_{\mathbf{6}}$ | FC | $\mathbf{R}_{\mathbf{9}}$ |

## ADD-ON RATE INSTALLMENT LOAN (CARD 2)

| KEYS | CODE |
| :--- | ---: |
| 0 | 00 |
| $\vdots$ | 81 |
| LBL | 23 |
| A | 11 |
| RCL 3 | 3403 |
| 1 | 01 |
| 2 | 02 |
| EEX | 43 |
| 2 | 02 |
| $\div$ | 81 |
| 0 | 00 |
| gx $=y$ | 3523 |
| RTN | 24 |
| g NOP | 3501 |
| g R $\downarrow$ | 3508 |
| STO 6 | 3306 |
| LBL | 23 |
| 1 | 01 |
| 1 | 01 |
| RCL 6 | 3406 |
| 1 | 01 |
| + | 61 |
| STO 7 | 3307 |
| RCL 1 | 3401 |
| CHS | 42 |
| g | 35 |
| y | 05 |
| STO 8 | 3308 |
| - | 51 |
| RCL 6 | 3406 |
| $\div$ | 81 |
| RCL 5 | 3405 |
| $x$ | 71 |
| RCL 7 | 3407 |
| RCL 2 | 3402 |
|  |  |


| KEYS | CODE |
| :---: | :---: |
| g | 35 |
| $y^{x}$ | 05 |
| RCL 4 | 3404 |
| x | 71 |
| - | 51 |
| RCL 8 | 3408 |
| RCL 7 | 3407 |
| $\div$ | 81 |
| RCL 1 | 3401 |
| 1 | 01 |
| + | 61 |
| x | 71 |
| RCL 6 | 3406 |
| x | 71 |
| 1 | 01 |
| RCL 8 | 3408 |
| - | 51 |
| RCL 6 | 3406 |
| + | 61 |
| - | 51 |
| RCL 6 | 3406 |
| $\uparrow$ | 41 |
| x | 71 |
| $\div$ | 81 |
| RCL 5 | 3405 |
| x | 71 |
| RCL 7 | 3407 |
| RCL 2 | 3402 |
| g | 35 |
| $\mathrm{y}^{\mathrm{x}}$ | 05 |
| RCL 7 | 3407 |
| $\div$ | 81 |
| RCL 2 | 3402 |
| $\mathrm{g} \times \stackrel{\mathrm{y}}{ } \mathrm{y}$ | 3507 |
| x | 71 |


| KEYS | CODE |
| :---: | :---: |
| g LST X | 3500 |
| - | 51 |
| RCL 4 | 3404 |
| x | 71 |
| - | 51 |
| $\div$ | 81 |
| RCL 6 | 3406 |
| $\mathrm{gx} \overrightarrow{\mathrm{y}}$ | 3507 |
|  | 51 |
| STO 6 | 3306 |
| g LST X | 3500 |
| g | 35 |
| ABS | 06 |
| EEX | 43 |
| 6 | 06 |
| CHS | 42 |
| $\mathrm{g} x \leqslant y$ | 3522 |
| GTO | 22 |
| 1 | 01 |
| RCL 6 | 3406 |
| 1 | 01 |
| 2 | 02 |
| 0 | 00 |
| 0 | 00 |
| x | 71 |
| R/S | 84 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |


| $\mathbf{R}_{\mathbf{1}}$ | $\mathbf{N}$ | $\mathbf{R}_{\mathbf{4}}$ | AMT | $\mathbf{R}_{\mathbf{7}}$ | $\mathbf{1}+\mathrm{i} / 100$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | ODD | $\mathbf{R}_{\mathbf{5}}$ | PMT | $\mathbf{R}_{\mathbf{8}}$ | $(1+\mathrm{i} / 100)^{-\mathbf{N}}$ |
| $\mathbf{R}_{\mathbf{3}}$ | AIR | $\mathbf{R}_{\mathbf{6}}$ | APR $/ 100$ | $\mathbf{R}_{\mathbf{9}}$ | Used |

## CONSTANT PAYMENT TO PRINCIPAL LOAN AMORTIZATION SCHEDULE

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| LBL | 23 | RCL 3 | 3403 | RCL 2 | 3402 |
| A | 11 | + | 61 | x | 71 |
| STO 1 | 3301 | 1 | 01 | RCL 4 | 3404 |
| RTN | 24 | STO | 33 | $\times$ | 71 |
| LBL | 23 | + | 61 | RTN | 24 |
| B | 12 | 1 | 01 | LBL | 23 |
| EEX | 43 | RCL 6 | 3406 | E | 15 |
| 2 | 02 | RTN | 24 | RCL 1 | 3401 |
| $\div$ | 81 | LBL | 23 | RTN | 24 |
| STO 2 | 3302 | E | 15 | g NOP | 3501 |
| EEX | 43 | RCL 6 | 3406 | g NOP | 3501 |
| 2 | 02 | RCL 3 | 3403 | g NOP | 3501 |
| x | 71 | + | 61 | g NOP | 3501 |
| RTN | 24 | RTN | 24 | g NOP | 3501 |
| LBL | 23 | LBL | 23 | g NOP | 3501 |
| C | 13 | E | 15 | g NOP | 3501 |
| STO 3 | 3303 | RCL 5 | 3405 | g NOP | 3501 |
| RTN | 24 | RTN | 24 | g NOP | 3501 |
| LBL | 23 | LBL | 23 | g NOP | 3501 |
| D | 14 | E | 15 | g NOP | 3501 |
| STO 4 | 3304 | 2 | 02 | g NOP | 3501 |
| RTN | 24 | RCL 1 | 3401 | g NOP | 3501 |
| LBL | 23 | - | 51 | g NOP | 3501 |
| E | 15 | RCL 3 | 3403 | g NOP | 3501 |
| RCL 4 | 3404 | x | 71 | g NOP | 3501 |
| RCL 3 | 3403 | RCL 4 | 3404 | g NOP | 3501 |
| RCL 1 | 3401 | $\div$ | 81 | g NOP | 3501 |
| x | 71 | 2 | 02 | g NOP | 3501 |
| - | 51 | + | 61 | g NOP | 3501 |
| STO 5 | 3305 | 2 | 02 | g NOP | 3501 |
| RCL 3 | 3403 | $\div$ | 81 |  |  |
| + | 61 | RCL 1 | 3401 |  |  |
| RCL 2 | 3402 | 1 | 01 |  |  |
| x | 71 | - | 51 |  |  |
| STO 6 | 3306 | x | 71 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | K | $\mathbf{R}_{\mathbf{4}}$ | PV |
| :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $\mathrm{i} / 100$ | $\mathbf{R}_{\mathbf{5}}$ | BAL |
| $\mathbf{R}_{\mathbf{3}}$ | CPP | $\mathbf{R}_{\mathbf{6}}$ | $\mathrm{PMT}_{\mathbf{i}}$ |

INTEREST REBATE-RULE OF 78's

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| LBL | 23 | STO 5 | 3305 | g NOP | 3501 |
| A | 11 | RTN | 24 | g NOP | 3501 |
| STO 1 | 3301 | LBL | 23 | g NOP | 3501 |
| RTN | 24 | E | 15 | g NOP | 3501 |
| LBL | 23 | RCL 3 | 3403 | g NOP | 3501 |
| B | 12 | RCL 1 | 3401 | g NOP | 3501 |
| STO 2 | 3302 | RCL 2 | 3402 | g NOP | 3501 |
| RTN | 24 | - | 51 | g NOP | 3501 |
| LBL | 23 | x | 71 | g NOP | 3501 |
| C | 13 | RCL 5 | 3405 | g NOP | 3501 |
| STO 3 | 3303 | - | 51 | g NOP | 3501 |
| RTN | 24 | RTN | 24 | g NOP | 3501 |
| LBL | 23 | g NOP | 3501 | g NOP | 3501 |
| D | 14 | g NOP | 3501 | g NOP | 3501 |
| STO 4 | 3304 | g NOP | 3501 | g NOP | 3501 |
| RTN | 24 | g NOP | 3501 | g NOP | 3501 |
| LBL | 23 | g NOP | 3501 | g NOP | 3501 |
| E | 15 | g NOP | 3501 | g NOP | 3501 |
| RCL 1 | 3401 | g NOP | 3501 | g NOP | 3501 |
| RCL 2 | 3402 | g NOP | 3501 | g NOP | 3501 |
| - | 51 | g NOP | 3501 | g NOP | 3501 |
| 1 | 01 | g NOP | 3501 | g NOP | 3501 |
| + | 61 | g NOP | 3501 | g NOP | 3501 |
| RCL 4 | 3404 | g NOP | 3501 | g NOP | 3501 |
| x | 71 | g NOP | 3501 | g NOP | 3501 |
| RCL 1 | 3401 | g NOP | 3501 | g NOP | 3501 |
| $\uparrow$ | 41 | g NOP | 3501 | g NOP | 3501 |
| x | 71 | g NOP | 3501 | g NOP | 3501 |
| g LST X | 3500 | g NOP | 3501 | g NOP | 3501 |
| + | 61 | g NOP | 3501 | g NOP | 3501 |
| $\div$ | 81 | g NOP | 3501 |  |  |
| RCL 1 | 3401 | g NOP | 3501 |  |  |
| RCL 2 | 3402 | g NOP | 3501 |  |  |
| - | 51 | g NOP | 3501 |  |  |
| x | 71 | g NOP | 3501 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | $\mathbf{N}$ | $\mathbf{R}_{\mathbf{4}}$ | FC | $\mathbf{R}_{\mathbf{7}}$ |
| :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | K | $\mathbf{R}_{\mathbf{5}}$ | REB | $\mathbf{R}_{\mathbf{8}}$ |
| $\mathbf{R}_{\mathbf{3}}$ | PMT | $\mathbf{R}_{\mathbf{6}}$ |  | $\mathbf{R}_{\mathbf{9}}$ |

INTERNAL RATE OF RETURN UP TO 12 CASH FLOWS (CARD 1)

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| f | 31 | LBL | 23 | + | 61 |
| REG | 43 | B | 12 | 9 | 09 |
| $\mathrm{f}^{-1}$ | 32 | E | 15 | RCL 1 | 3401 |
| SF 1 | 51 | STO | 33 | $\div$ | 81 |
| 2 | 02 | + | 61 | f | 31 |
| x | 71 | 6 | 06 | TF 1 | 61 |
| STO 2 | 3302 | g R $\downarrow$ | 3508 | f | 31 |
| STO 1 | 3301 | RTN | 24 | INT | 83 |
| 2 | 02 | LBL | 23 | RTN | 24 |
| $\div$ | 81 | B | 12 | LBL | 23 |
| RTN | 24 | E | 15 | C | 13 |
| LBL | 23 | STO | 33 | $\uparrow$ | 41 |
| B | 12 | + | 61 | STO | 33 |
| E | 15 | 7 | 07 | $\div$ | 81 |
| STO | 33 | $g \mathrm{R} \downarrow$ | 3508 | 9 | 09 |
| + | 61 | RTN | 24 | RCL 2 | 3402 |
| 3 | 03 | LBL | 23 | $\div$ | 81 |
| $\mathrm{g} \mathrm{R} \downarrow$ | 3508 | B | 12 | STO 1 | 3301 |
| RTN | 24 | E | 15 | RCL | 34 |
| LBL | 23 | STO | 33 | 9 | 09 |
| B | 12 | + | 61 | - | 83 |
| E | 15 | 8 | 08 | 1 | 01 |
| STO | 33 | RCL 1 | 3401 | x | 71 |
| + | 61 | EEX | 43 | - | 83 |
| 4 | 04 | 5 | 05 | 9 | 09 |
| $\mathrm{g} \mathrm{R} \downarrow$ | 3508 | $\div$ | 81 | $+$ | 61 |
| RTN | 24 | STO 1 | 3301 | STO 2 | 3302 |
| LBL | 23 | f | 31 | $\mathrm{g} R \uparrow$ | 3509 |
| B | 12 | SF 1 | 51 | RTN | 24 |
| E | 15 | $\mathrm{gR} \uparrow$ | 3509 | g NOP | 3501 |
| STO | 33 | RTN | 24 |  |  |
| + | 61 | LBL | 23 |  |  |
| 5 | 05 | E | 15 |  |  |
| $\mathrm{gR} \downarrow$ | 3508 | $\uparrow$ | 41 |  |  |
| RTN | 24 | STO | 33 |  |  |


| $\mathrm{R}_{1}$ | INV/2 CF MAX | $\mathrm{R}_{4}$ | $\mathrm{CF}_{8} \cdot \mathrm{CF}_{2}$ | $\mathrm{R}_{7}$ | $\mathrm{CF}_{11} \cdot \mathrm{CF}_{5}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{R}_{2}$ | 2 CF MAX | $\mathrm{R}_{5}$ | $\mathrm{CF}_{9} \cdot \mathrm{CF}_{3}$ | $\mathbf{R}_{8}$ | $\mathrm{CF}_{12} \cdot \mathrm{CF}_{6}$ |
| $\mathrm{R}_{3}$ | $\mathrm{CF}_{7} \cdot \mathrm{CF}_{1}$ | $\mathbf{R}_{6}$ | $\mathrm{CF}_{10} \cdot \mathrm{CF}_{4}$ | $\mathbf{R}_{9}$ | $\Sigma \mathrm{CF}$ |

INTERNAL RATE OF RETURN UP TO 12 CASH FLOWS (CARD 2)

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | 00 | 2 | 02 | INT | 83 |
| STO | 33 | RCL | 34 | EEX | 43 |
| 9 | 09 | 9 | 09 | 5 | 05 |
| RCL 2 | 3402 | RCL 1 | 3401 | $\div$ | 81 |
| $\mathrm{f}^{-1}$ | 32 | - | 51 | $\mathrm{g} \times \vec{y}$ | 3507 |
| SF 1 | 51 | $\mathrm{g} \times \overrightarrow{\mathrm{F}} \mathrm{y}$ | 3507 | 5 | 05 |
| LBL | 23 | $\div$ | 81 | + | 61 |
| 1 | 01 | RCL 2 | 3402 | $\mathrm{g} \times \underset{ }{\rightleftarrows} \mathrm{y}$ | 3507 |
| 1 | 01 | $\mathrm{g} \times \underset{y}{ }$ | 3507 | GTO | 22 |
| RCL 8 | 3408 | + | 61 | 4 | 04 |
| E | 15 | STO 2 | 3302 | LBL | 23 |
| 2 | 02 | g LST X | 3500 | 3 | 03 |
| RCL 7 | 3407 | g | 35 | $\mathrm{f}^{-1}$ | 32 |
| E | 15 | ABS | 06 | INT | 83 |
| 3 | 03 | EEX | 43 | LBL | 23 |
| RCL 6 | 3406 | 5 | 05 | 4 | 04 |
| E | 15 | CHS | 42 | STO | 33 |
| 4 | 04 | $\mathrm{g} x \leqslant y$ | 3522 | + | 61 |
| RCL 5 | 3405 | GTO | 22 | 9 | 09 |
| E | 15 | A | 11 | X | 71 |
| 5 | 05 | RCL 2 | 3402 | + | 61 |
| RCL 4 | 3404 | 1 | 01 | RCL 2 | 3402 |
| E | 15 | - | 51 | STO | 33 |
| 6 | 06 | STO 2 | 3302 | $\div$ | 81 |
| RCL 3 | 3403 | EEX | 43 | 9 | 09 |
| E | 15 | 2 | 02 | $\div$ | 81 |
| f | 31 | x | 71 | RTN | 24 |
| TF 1 | 61 | RTN | 24 | g NOP | 3501 |
| GTO | 22 | LBL | 23 | g NOP | 3501 |
| 2 | 02 | E | 15 | g NOP | 3501 |
| f | 31 | f | 31 |  |  |
| SF 1 | 51 | TF 1 | 61 |  |  |
| GTO | 22 | GTO | 22 |  |  |
| 1 | 01 | 3 | 03 |  |  |
| LBL | 23 | f | 31 |  |  |


| R | INV/2 CF MAX | $\mathrm{R}_{4}$ | $\mathrm{CF}_{8} \cdot \mathrm{CF}_{2}$ | $\mathrm{R}_{7}$ | $\mathrm{CF}_{11} \cdot \mathrm{CF}_{5}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathrm{R}^{2}$ | $\mathrm{i} / 100,(1+\mathrm{i} / 100)$ | $\mathrm{R}_{5}$ | $\mathrm{CF}_{9} \cdot \mathrm{CF}_{3}$ | $\mathrm{R}_{8}$ | $\mathrm{CF}_{12} \cdot \mathrm{CF}_{6}$ |
| $\mathrm{R}_{3}$ | $\mathrm{CF}_{7} \cdot \mathrm{CF}_{1}$ | $\mathrm{R}_{6}$ | $\mathrm{CF}_{10} \cdot \mathrm{CF}_{4}$ | $\mathbf{R}_{9}$ | $f(i)$ |

INTERNAL RATE OF RETURN UP TO 7 CASH FLOWS

| KEYS | CODE |
| :---: | :---: |
| $\mathrm{gR} \uparrow$ | 3509 |
| 0 | 00 |
| STO | 33 |
| 9 | 09 |
| 7 | 07 |
| RCL 7 | 3407 |
| E | 15 |
| 6 | 06 |
| RCL 6 | 3406 |
| E | 15 |
| 5 | 05 |
| RCL 5 | 3405 |
| E | 15 |
| 4 | 04 |
| RCL 4 | 3404 |
| E | 15 |
| 3 | 03 |
| RCL 3 | 3403 |
| E | 15 |
| 2 | 02 |
| RCL 2 | 3402 |
| E | 15 |
| 1 | 01 |
| RCL 1 | 3401 |
| E | 15 |
| RCL | 34 |
| 9 | 09 |
| RCL 8 | 3408 |
| - | 51 |
| $g \times \rightleftarrows \mathrm{y}$ | 3507 |
| $\div$ | 81 |
| x | 71 |
| + | 61 |
| g LST X | 3500 |
| g | 35 |


| KEYS | CODE |
| :--- | ---: |
| ABS | 06 |
| EEX | 43 |
| CHS | 42 |
| 6 | 06 |
| gx $\leqslant y$ | 3522 |
| $\uparrow$ | 41 |
| GTO | 22 |
| 0 | 00 |
| gR $\uparrow$ | 3509 |
| 1 | 01 |
| - | 51 |
| EEX | 43 |
| 2 | 02 |
| x | 71 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| STO | 33 |
| + | 61 |
| 9 | 09 |
| $x$ | 71 |
| + | 61 |
| gx $+y$ | 3507 |
| STO | 33 |
| $\vdots$ | 81 |
| 9 | 09 |
| $\vdots$ | 81 |
| RTN | 24 |
| LBL | 23 |
| A | 11 |
| f | 31 |
| REG | 43 |
| STO 1 | 3301 |
| RTN | 24 |
| LBL | 23 |
|  |  |


| KEYS | CODE |
| :--- | ---: |
| A | 11 |
| STO 2 | 3302 |
| RTN | 24 |
| LBL | 23 |
| A | 11 |
| STO 3 | 3303 |
| RTN | 24 |
| LBL | 23 |
| A | 11 |
| STO 4 | 3304 |
| RTN | 24 |
| LBL | 23 |
| A | 11 |
| STO 5 | 3305 |
| RTN | 24 |
| LBL | 23 |
| A | 11 |
| STO 6 | 3306 |
| RTN | 24 |
| LBL | 23 |
| A | 11 |
| STO 7 | 3307 |
| LBL | 23 |
| B | 12 |
| STO 8 | 3308 |
| RTN | 24 |
| LBL | 23 |
| C | 13 |
| 1 | 01 |
| gR $\downarrow$ | 3508 |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |


| $\mathbf{R}_{\mathbf{1}}$ | CF | $\mathbf{1}$ | $\mathbf{R}_{\mathbf{4}}$ | CF | $\mathbf{4}$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | CF | $\mathbf{2}$ | CF |  |  |

## DISCOUNTED CASH FLOW ANALYSIS <br> NET PRESENT VALUE

| KEYS | CODE |
| :--- | ---: |
| LBL | 23 |
| A | 11 |
| CHS | 42 |
| STO 5 | 3305 |
| 0 | 00 |
| STO 7 | 3307 |
| 1 | 01 |
| STO 1 | 3301 |
| RCL 5 | 3405 |
| CHS | 42 |
| RTN | 24 |
| LBL | 23 |
| B | 12 |
| EEX | 43 |
| 2 | 02 |
| $\vdots$ | 81 |
| STO 2 | 3302 |
| g LST X | 3500 |
| x | 71 |
| RTN | 24 |
| LBL | 23 |
| C | 13 |
| STO 1 | 3301 |
| RTN | 24 |
| LBL | 23 |
| D | 14 |
| STO 3 | 3303 |
| 1 | 01 |
| RCL 2 | 3402 |
| + | 61 |
| RCL 1 | 3401 |
| STO | 33 |
| + | 61 |
| 7 | 07 |
| g | 35 |
|  |  |


| KEYS | CODE |
| :--- | ---: |
| $\mathrm{y}^{\mathrm{x}}$ | 05 |
| STO 6 | 3306 |
| RCL 5 | 3405 |
| x | 71 |
| RCL 6 | 3406 |
| 1 | 01 |
| - | 51 |
| RCL 2 | 3402 |
| $\vdots$ | 81 |
| RCL 3 | 3403 |
| x | 71 |
| + | 61 |
| STO 5 | 3305 |
| 1 | 01 |
| RCL 2 | 3402 |
| + | 61 |
| RCL 7 | 3407 |
| g | 35 |
| y | 05 |
| $\vdots$ | 81 |
| 1 | 01 |
| STO 1 | 3301 |
| g R $\downarrow$ | 3508 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 7 | 3407 |
| RTN | 24 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
|  |  |
|  |  |


| KEYS | CODE |
| :--- | :--- |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |


| $\mathbf{R}_{\mathbf{1}} \#$ | $\mathbf{R}_{\mathbf{4}}$ | $\mathbf{R}_{\mathbf{7}} \quad \mathrm{\Sigma n}$ |
| :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}} \mathrm{i} / \mathbf{1 0 0}$ | $\mathbf{R}_{\mathbf{5}} \mathrm{NPV}$ | $\mathbf{R}_{\mathbf{8}}$ |
| $\mathbf{R}_{\mathbf{3}} \mathrm{CF}$ | $\mathbf{R}_{\mathbf{6}}(\mathbf{1 + i})^{\mathbf{n}}$ | $\mathbf{R}_{\mathbf{9}}$ |

## STRAIGHT LINE DEPRECIATION SCHEDULE

| KEYS | CODE |
| :--- | ---: |
| LBL | 23 |
| A | 11 |
| STO 1 | 3301 |
| RTN | 24 |
| LBL | 23 |
| B | 12 |
| STO 2 | 3302 |
| RTN | 24 |
| LBL | 23 |
| C | 13 |
| STO 3 | 3303 |
| RTN | 24 |
| LBL | 23 |
| D | 14 |
| STO 4 | 3304 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 4 | 3404 |
| RCL 3 | 3403 |
| 1 | 01 |
| + | 61 |
| gx $\leqslant y$ | 3522 |
| 0 | 00 |
| $\vdots$ | 81 |
| RCL 3 | 3403 |
| RCL 4 | 3404 |
| g x>y | 3524 |
| - | 51 |
| + | 61 |
| 1 | 01 |
| g LST x | 3500 |
| fri | 32 |
| INT | 83 |
| + | 61 |


| KEYS | CODE |
| :--- | ---: |
| RCL 3 | 3403 |
| $\vdots$ | 81 |
| RCL 1 | 3401 |
| RCL 2 | 3402 |
| - | 51 |
| x | 71 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| 0 | 00 |
| STO 6 | 3306 |
| RCL 3 | 3403 |
| RCL 4 | 3404 |
| g x>y | 3524 |
| 0 | 00 |
| RTN | 24 |
| - | 51 |
| RCL 3 | 3403 |
| $\vdots$ | 81 |
| RCL 1 | 3401 |
| RCL 2 | 3402 |
| - | 51 |
| x | 71 |
| STO 6 | 3306 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 6 | 3406 |
| RCL 2 | 3402 |
| + | 61 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 1 | 3401 |
| RCL 2 | 3402 |
|  |  |


| KEYS | CODE |
| :--- | ---: |
| - | 51 |
| RCL 6 | 3406 |
| - | 51 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 4 | 3404 |
| 1 | 01 |
| + | 61 |
| STO 4 | 3304 |
| RTN | 24 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
|  |  |
|  |  |
|  |  |
|  |  |


| $\mathbf{R}_{\mathbf{1}}$ SBV | $\mathbf{R}_{\mathbf{4}}$ YR | $\mathbf{R}_{\mathbf{7}}$ |
| :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ SAL | $\mathbf{R}_{\mathbf{5}}$ | $\mathbf{R}_{\mathbf{8}}$ |
| $\mathbf{R}_{\mathbf{3}}$ LIFE | $\mathbf{R}_{\mathbf{6}}$ Used | $\mathbf{R}_{\mathbf{9}}$ Used |

## SUM OF THE YEARS' DIGITS DEPRECIATION SCHEDULE

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| STO 4 | 3304 | LBL | 23 | 1 | 01 |
| RTN | 24 | E | 15 | A | 11 |
| LBL | 23 | RCL 1 | 3401 | RCL 7 | 3407 |
| B | 12 | RCL 2 | 3402 | $\div$ | 81 |
| STO 2 | 3302 | - | 51 | RCL 8 | 3408 |
| RTN | 24 | STO 8 | 3308 | x | 71 |
| LBL | 23 | RCL 3 | 3403 | LBL | 23 |
| C | 13 | 0 | 00 | 1 | 01 |
| STO 3 | 3303 | A | 11 | STO 5 | 3305 |
| RTN | 24 | STO 7 | 3307 | RTN | 24 |
| LBL | 23 | RCL 4 | 3404 | LBL | 23 |
| A | 11 | RCL 3 | 3403 | E | 15 |
| 0 | 00 | 1 | 01 | RCL 8 | 3408 |
| $g x \nleftarrow y$ | 3507 | + | 61 | RCL 5 | 3405 |
|  | 3521 | $\mathrm{g} x \leqslant y$ | 3522 | - | 51 |
| STO 1 | 3301 | 0 | 00 | STO 5 | 3305 |
| RTN | 24 | $\div$ | 81 | RCL 1 | 3401 |
| $g \mathrm{R} \downarrow$ | 3508 | RCL 3 | 3403 | $\mathrm{g} \mathrm{x} \stackrel{y}{ }$ | 3507 |
| $g \mathrm{R} \downarrow$ | 3508 | 1 | 01 | - | 51 |
| $\uparrow$ | 41 | + | 61 | RTN | 24 |
| $\mathrm{f}^{-1}$ | 32 | RCL 4 | 3404 | LBL | 23 |
| INT | 83 | - | 51 | E | 15 |
| $\uparrow$ | 41 | RCL 7 | 3407 | RCL 5 | 3405 |
| $+$ | 61 | $\div$ | 81 | RTN | 24 |
| $g x \nLeftarrow y$ | 3507 | RCL 8 | 3408 | LBL | 23 |
| $f$ | 31 | x | 71 | E | 15 |
| INT | 83 | RTN | 24 | RCL 4 | 3404 |
| + | 61 | LBL | 23 | 1 | 01 |
| g LST X | 3500 | E | 15 | + | 61 |
| 1 | 01 | RCL 3 | 3403 | g NOP | 3501 |
| + | 61 | RCL 4 | 3404 |  |  |
| $\times$ | 71 | - | 51 |  |  |
| 2 | 02 | 0 | 00 |  |  |
| $\div$ | 81 | $\mathrm{gx}>\mathrm{y}$ | 3524 |  |  |
| RTN | 24 | GTO | 22 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | SBV | $\mathbf{R}_{\mathbf{4}}$ | YR | $\mathbf{R}_{\mathbf{7}}$ | SOD |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | SAL | $\mathbf{R}_{\mathbf{5}}$ | RDV |  | $\mathbf{R}_{\mathbf{k}}$ |
|  | SBV-SAL |  |  |  |  |
| $\mathbf{R}_{\mathbf{3}}$ | LIFE | $\mathbf{R}_{\mathbf{6}}$ |  | $\mathbf{R}_{\mathbf{9}}$ | Used |

## VARIABLE RATE DECLINING <br> BALANCE DEPRECIATION SCHEDULE

| KEYS | CODE |
| :--- | ---: |
| STO 4 | 3304 |
| RTN | 24 |
| LBL | 23 |
| A | 11 |
| STO 1 | 3301 |
| RTN | 24 |
| LBL | 23 |
| A | 11 |
| STO 2 | 3302 |
| RTN | 24 |
| LBL | 23 |
| B | 12 |
| STO 3 | 3303 |
| RTN | 24 |
| LBL | 23 |
| C | 13 |
| STO 5 | 3305 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 4 | 3404 |
| RCL 3 | 3403 |
| 1 | 01 |
| + | 61 |
| gx $\leqslant y$ | 3522 |
| 0 | 00 |
| $\vdots$ | 81 |
| 1 | 01 |
| RCL 5 | 3405 |
| RCL 3 | 3403 |
| $\vdots$ | 81 |
| STO 6 | 3306 |
|  | 51 |
| STO 7 | 3307 |
| RCL 4 | 3404 |


| KEYS | CODE |
| :--- | ---: |
| $\mathbf{1}$ | 01 |
| - | 51 |
| g | 35 |
| $\mathrm{y}^{\mathrm{x}}$ | 05 |
| RCL 6 | 3406 |
| x | 71 |
| RCL 1 | 3401 |
| x | 71 |
| STO 8 | 3308 |
| RCL 6 | 3406 |
| RCL 1 | 3401 |
| x | 71 |
| 1 | 01 |
| RCL 7 | 3407 |
| RCL 4 | 3404 |
| g | 35 |
| y | 05 |
| - | 51 |
| x | 71 |
| 1 | 01 |
| RCL 7 | 3407 |
| - | 51 |
| $\vdots$ | 81 |
| STO 7 | 3307 |
| RCL 1 | 3401 |
| RCL 2 | 3402 |
| - | 51 |
| g x>y | 3524 |
| RCL 8 | 3408 |
| RTN | 24 |
| STO 7 | 3307 |
| - | 51 |
| RCL 8 | 3408 |
| - | 51 |
| CHS | 42 |
|  |  |


| KEYS | CODE |
| :--- | ---: |
| 0 | 00 |
| gx>y | 3524 |
| RTN | 24 |
| g NOP | 3501 |
| gx $\underset{\text { R }}{ }$ | 3507 |
| RTN | 24 |
| E | 23 |
| RCL 1 | 15 |
| RCL 2 | 3401 |
| - | 51 |
| RCL 7 | 3407 |
| - | 51 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 1 | 3401 |
| RCL 7 | 3407 |
| - | 51 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 7 | 3407 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 4 | 3404 |
| 1 | 01 |
|  | 61 |
| g NOP | 3501 |
|  |  |


| $\mathbf{R}_{\mathbf{1}}$ | SBV | $\mathbf{R}_{\mathbf{4}}$ | YR | $\mathbf{R}_{\mathbf{7}}$ | TOT DEP |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | SAL | $\mathbf{R}_{\mathbf{5}}$ | FACT | $\mathbf{R}_{\mathbf{8}}$ | DEP |
| $\mathbf{R}_{\mathbf{3}}$ | LIFE | $\mathbf{R}_{\mathbf{6}}$ | FACT/LIFE | $\mathbf{R}_{\mathbf{9}}$ | Used |

## CROSSOVER POINT-DECLINING BALANCE TO STRAIGHT LINE DEPRECIATION

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| STO 1 | 3301 | $\mathrm{g} x \leqslant y$ | 3522 | $y^{x}$ | 05 |
| RTN | 24 | 0 | 00 | RCL 7 | 3407 |
| LBL | 23 | $\div$ | 81 | x | 71 |
| B | 12 | RCL 8 | 3408 | RCL 1 | 3401 |
| STO 2 | 3302 | RCL 4 | 3404 | x | 71 |
| RTN | 24 | 1 | 01 | - | 51 |
| LBL | 23 | - | 51 | 0 | 00 |
| C | 13 | g | 35 | $\mathrm{gx}>\mathrm{y}$ | 3524 |
| STO 3 | 3303 | $y^{x}$ | 05 | GTO | 22 |
| RTN | 24 | 1 | 01 | 1 | 01 |
| LBL | 23 | - | 51 | RCL 4 | 3404 |
| D | 14 | 1 | 01 | 1 | 01 |
| STO 5 | 3305 | RCL 8 | 3408 | - | 51 |
| RTN | 24 | - | 51 | RTN | 24 |
| LBL | 23 | $\div$ | 81 | LBL | 23 |
| E | 15 | RCL 7 | 3407 | E | 15 |
| 0 | 00 | x | 71 | RCL 3 | 3403 |
| STO 4 | 3304 | RCL 1 | 3401 | RCL 4 | 3404 |
| 1 | 01 | x | 71 | - | 51 |
| RCL 5 | 3405 | RCL 1 | 3401 | 1 | 01 |
| RCL 3 | 3403 | + | 61 | + | 61 |
| $\div$ | 81 | RCL 2 | 3402 | RTN | 24 |
| STO 7 | 3307 | - | 51 | LBL | 23 |
| - | 51 | STO 6 | 3306 | E | 15 |
| STO 8 | 3308 | RCL 3 | 3403 | RCL 6 | 3406 |
| LBL | 23 | RCL 4 | 3404 | RCL 2 | 3402 |
| 1 | 01 | - | 51 | + | 61 |
| 1 | 01 | 1 | 01 | RTN | 24 |
| STO | 33 | + | 61 | g NOP | 3501 |
| + | 61 | $\div$ | 81 | g NOP | 3501 |
| 4 | 04 | RCL 8 | 3408 |  |  |
| RCL 4 | 3404 | RCL 4 | 3404 |  |  |
| RCL 3 | 3403 | 1 | 01 |  |  |
| 1 | 01 | - | 51 |  |  |
| + | 61 | g | 35 |  |  |
| $\mathbf{R}_{1}$ SBV |  | $\mathbf{R}_{\mathbf{4}}$ YEAR |  | $\mathbf{R}_{7}$ FACT | IFE |
| $\mathbf{R}_{\mathbf{2}} \mathrm{SAL}$ |  | $\mathbf{R}_{5}$ FACT |  | $\mathbf{R}_{8} 1-\mathrm{F}$ | CT/LIFE |
| $\mathbf{R}_{\mathbf{3}}$ LIFE |  | $\mathbf{R}_{6} \mathrm{BV}$ |  | $\mathbf{R}_{9}$ Used |  |

DAYS BETWEEN DATES (ACTUAL)

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| STO 8 | 3308 | STO 4 | 3304 | 4 | 04 |
| RTN | 24 | - | 51 | x | 71 |
| LBL | 23 | EEX | 43 | - | 83 |
| B | 12 | 2 | 02 | 3 | 03 |
| STO 2 | 3302 | $\times$ | 71 | + | 61 |
| RTN | 24 | $\uparrow$ | 41 | + | 61 |
| LBL | 23 | f | 31 | f | 31 |
| C | 13 | INT | 83 | INT | 83 |
| RCL 8 | 3408 | STO 6 | 3306 | - | 51 |
| D | 14 | - | 51 | RCL 7 | 3407 |
| STO 3 | 3303 | EEX | 43 | LBL | 23 |
| g LST X | 3500 | 4 | 04 | 2 | 02 |
| STO 1 | 3301 | x | 71 | CLX | 44 |
| RCL 2 | 3402 | STO 7 | 3307 | RCL 6 | 3406 |
| D | 14 | 3 | 03 | + | 61 |
| g LST X | 3500 | 6 | 06 | RCL 4 | 3404 |
| STO | 33 | 5 | 05 | 1 | 01 |
| - | 51 | STO 5 | 3305 | - | 51 |
| 1 | 01 | $\times$ | 71 | 3 | 03 |
| CLX | 44 | 2 | 02 | 1 | 01 |
| RCL 3 | 3403 | RCL 4 | 3404 | x | 71 |
| - | 51 | $\mathrm{gx}>\mathrm{y}$ | 3524 | + | 61 |
| RCL 5 | 3405 | GTO | 22 | RCL 7 | 3407 |
| 2 | 02 | 1 | 01 | 4 | 04 |
| $\div$ | 81 | x | 71 | $\div$ | 81 |
| STO | 33 | CLX | 44 | f | 31 |
| $\div$ | 81 | RCL 7 | 3407 | INT | 83 |
| 1 | 01 | 1 | 01 | $\mathrm{g} \times \overrightarrow{\mathrm{z}}$ | 3507 |
| $g \times \vec{y}$ | 3507 | - | 51 | $+$ | 61 |
| RTN | 24 | STO 7 | 3307 | RTN | 24 |
| LBL | 23 | GTO | 22 |  |  |
| D | 14 | 2 | 02 |  |  |
| $\uparrow$ | 41 | LBL | 23 |  |  |
| f | 31 | 1 | 01 |  |  |
| INT | 83 | - | 83 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ PER | $\mathbf{R}_{\mathbf{4}}$ M | $\mathbf{R}_{\mathbf{7}}$ | Y, Z |
| :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ DT2 | $\mathbf{R}_{\mathbf{5}}$ 365 | $\mathbf{R}_{\mathbf{8}}$ DT1 |  |
| $\mathbf{R}_{\mathbf{3}}$ Used | $\mathbf{R}_{\mathbf{6}}$ D | $\mathbf{R}_{\mathbf{9}}$ Used |  |

## DAYS BETWEEN DATES (30/360 BASIS)

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| STO 8 | 3308 | EEX | 43 | RCL 3 | 3403 |
| RTN | 24 | 2 | 02 | 3 | 03 |
| LBL | 23 | x | 71 | 0 | 00 |
| B | 12 | $\uparrow$ | 41 | $\mathrm{g} \mathrm{x}=\mathrm{y}$ | 3523 |
| STO 2 | 3302 | f | 31 | GTO | 22 |
| RTN | 24 | INT | 83 | 2 | 02 |
| LBL | 23 | STO 6 | 3306 | $\mathrm{g} \mathrm{R} \downarrow$ | 3508 |
| C | 13 | - | 51 | CLX | 44 |
| 3 | 03 | EEX | 43 | RCL 6 | 3406 |
| 0 | 00 | 4 | 04 | STO 3 | 3303 |
| STO 3 | 3303 | X | 71 | + | 61 |
| RCL 8 | 3408 | 3 | 03 | RTN | 24 |
| D | 14 | 6 | 06 | LBL | 23 |
| STO 1 | 3301 | 0 | 00 | 2 | 02 |
| RCL 2 | 3402 | STO 5 | 3305 | g R $\downarrow$ | 3508 |
| D | 14 | x | 71 | STO 3 | 3303 |
| RCL 1 | 3401 | RCL 4 | 3404 | + | 61 |
| - | 51 | 3 | 03 | RTN | 24 |
| STO 1 | 3301 | 0 | 00 | g NOP | 3501 |
| RCL 5 | 3405 | x | 71 | g NOP | 3501 |
| CHS | 42 | + | 61 | g NOP | 3501 |
| 2 | 02 | RCL 6 | 3406 | g NOP | 3501 |
| $\div$ | 81 | 3 | 03 | g NOP | 3501 |
| STO | 33 | 1 | 01 | g NOP | 3501 |
| $\div$ | 81 | $g \mathrm{x}=\mathrm{y}$ | 3523 | g NOP | 3501 |
| 1 | 01 | GTO | 22 | g NOP | 3501 |
| $\mathrm{g} \mathrm{R} \downarrow$ | 3508 | 1 | 01 | g NOP | 3501 |
| RTN | 24 | g R $\downarrow$ | 3508 | g NOP | 3501 |
| LBL | 23 | STO 3 | 3303 | g NOP | 3501 |
| D | 14 | + | 61 | g NOP | 3501 |
| $\uparrow$ | 41 | RTN | 24 |  |  |
| f | 31 | LBL | 23 |  |  |
| INT | 83 | 1 | 01 |  |  |
| STO 4 | 3304 | $g \mathrm{R} \downarrow$ | 3508 |  |  |
| - | 51 | $g R \downarrow$ | 3508 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | PER | $\mathbf{R}_{\mathbf{4}}$ | M | $\mathbf{R}_{\mathbf{7}}$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | DT2 | $\mathbf{R}_{\mathbf{5}}$ | 360 | $\mathbf{R}_{\mathbf{8}}$ | DT1 |
| $\mathbf{R}_{\mathbf{3}}$ | Used | $\mathbf{R}_{\mathbf{6}}$ | D | $\mathbf{R}_{\mathbf{9}}$ | Used |

## BOND PRICE

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| LBL | 23 | INT | 83 | x | 71 |
| A | 11 | + | 61 | + | 61 |
| CHS | 42 | STO 6 | 3306 | RTN | 24 |
| STO 1 | 3301 | RCL 1 | 3401 | LBL | 23 |
| CHS | 42 | CHS | 42 | 1 | 01 |
| RTN | 24 | 1 | 01 | RCL 4 | 3404 |
| LBL | 23 | $\mathrm{gx}>\mathrm{y}$ | 3524 | 2 | 02 |
| B | 12 | GTO | 22 | $\div$ | 81 |
| EEX | 43 | 1 | 01 | RCL 3 | 3403 |
| 2 | 02 | RCL 7 | 3407 | + | 61 |
| STO 3 | 3303 | RCL 6 | 3406 | RCL 7 | 3407 |
| g R $\downarrow$ | 3508 | g | 35 | 1 | 01 |
| STO 4 | 3304 | $y^{x}$ | 05 | - | 51 |
| RTN | 24 | RCL 7 | 3407 | RCL 1 | 3401 |
| LBL | 23 | RCL 1 | 3401 | X | 71 |
| C | 13 | g | 35 | CHS | 42 |
| STO 2 | 3302 | $\mathrm{y}^{\mathrm{x}}$ | 05 | 1 | 01 |
| RTN | 24 | STO 7 | 3307 | + | 61 |
| LBL | 23 | - | 51 | $\div$ | 81 |
| D | 14 | RCL 4 | 3404 | RCL 4 | 3404 |
| STO 3 | 3303 | x | 71 | 2 | 02 |
| RTN | 24 | RCL 2 | 3402 | $\div$ | 81 |
| LBL | 23 | $\div$ | 81 | RCL 6 | 3406 |
| E | 15 | EEX | 43 | x | 71 |
| RCL 2 | 3402 | 2 | 02 | STO 5 | 3305 |
| 2 | 02 | x | 71 | - | 51 |
| 0 | 00 | RCL 6 | 3406 | RTN | 24 |
| 0 | 00 | 2 | 02 | g NOP | 3501 |
| $\div$ | 81 | $\div$ | 81 | g NOP | 3501 |
| 1 | 01 | RCL 4 | 3404 | g NOP | 3501 |
| + | 61 | $\times$ | 71 |  |  |
| STO 7 | 3307 | STO 5 | 3305 |  |  |
| 1 | 01 | - | 51 |  |  |
| RCL 1 | 3401 | RCL 7 | 3407 |  |  |
| $\mathrm{f}^{-1}$ | 32 | RCL 3 | 3403 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | -PER | $\mathbf{R}_{\mathbf{4}}$ | CR | $\mathbf{R}_{\mathbf{7}}$ | Used |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | YLD | $\mathbf{R}_{\mathbf{5}}$ | ACC INT | $\mathbf{R}_{\mathbf{8}}$ | DT1 |
| $\mathbf{R}_{\mathbf{3}}$ | RV | $\mathbf{R}_{\mathbf{6}}$ | J | $\mathbf{R}_{\mathbf{9}}$ | Used |

## BOND YIELD <br> (1 OR MORE REMAINING COUPON PERIODS)

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CHS | 42 | 1 | 01 | 1 | 01 |
| STO 1 | 3301 | RCL 3 | 3403 | RCL 7 | 3407 |
| CHS | 42 | RCL 5 | 3405 | 2 | 02 |
| RTN | 24 | $\div$ | 81 | 0 | 00 |
| LBL | 23 | 1 | 01 | 0 | 00 |
| B | 12 | RCL 7 | 3407 | $\times$ | 71 |
| EEX | 43 | + | 61 | STO 2 | 3302 |
| 2 | 02 | RCL 1 | 3401 | RTN | 24 |
| STO 3 | 3303 | g | 35 | RCL 5 | 3405 |
| g R $\downarrow$ | 3508 | $\mathrm{y}^{\mathrm{x}}$ | 05 | 1 | 01 |
| STO 4 | 3304 | STO 6 | 3306 | RCL 1 | 3401 |
| RTN | 24 | x | 71 | $\mathrm{f}^{-1}$ | 32 |
| LBL | 23 | - | 51 | INT | 83 |
| C | 13 | RCL 7 | 3407 | + | 61 |
| STO 5 | 3305 | x | 71 | g LST X | 3500 |
| RTN | 24 | 1 | 01 | x | 71 |
| LBL | 23 | RCL 6 | 3406 | 4 | 04 |
| D | 14 | - | 51 | $\div$ | 81 |
| STO 3 | 3303 | $\div$ | 81 | RCL 4 | 3404 |
| RTN | 24 | RCL 4 | 3404 | X | 71 |
| LBL | 23 | 2 | 02 | RCL 7 | 3407 |
| E | 15 | $\div$ | 81 | x | 71 |
| A | 11 | RCL 5 | 3405 | - | 51 |
| RCL 1 | 3401 | $\div$ | 81 | STO 5 | 3305 |
| f | 31 | - | 51 | GTO | 22 |
| INT | 83 | STO | 33 | 1 | 01 |
| $\div$ | 81 | - | 51 | g NOP | 3501 |
| RCL 4 | 3404 | 7 | 07 | g NOP | 3501 |
| 2 | 02 | g | 35 | g NOP | 3501 |
| $\div$ | 81 | ABS | 06 | g NOP | 3501 |
| RCL 5 | 3405 | EEX | 43 |  |  |
| $\div$ | 81 | CHS | 42 |  |  |
| STO 7 | 3307 | 6 | 06 |  |  |
| LBL | 23 | $\mathrm{g} x \leqslant y$ | 3522 |  |  |
| 1 | 01 | GTO | 22 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | -PER | $\mathbf{R}_{\mathbf{4}}$ | CR | $\mathbf{R}_{\mathbf{7}}$ | Used |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | YLD | $\mathbf{R}_{\mathbf{5}}$ | PRICE, Used | $\mathbf{R}_{\mathbf{8}}$ | DT1 |
| $\mathbf{R}_{\mathbf{3}}$ | RV | $\mathbf{R}_{\mathbf{6}}$ | Used | $\mathbf{R}_{\mathbf{9}}$ | Used |

## BOND YIELD (LESS THAN ONE REMAINING COUPON PERIOD)

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| LBL | 23 | + | 61 | g NOP | 3501 |
| A | 11 | g LST X | 3500 | g NOP | 3501 |
| CHS | 42 | RCL 1 | 3401 | g NOP | 3501 |
| STO 1 | 3301 | 1 | 01 | g NOP | 3501 |
| CHS | 42 | + | 61 | g NOP | 3501 |
| RTN | 24 | x | 71 | g NOP | 3501 |
| LBL | 23 | RCL 5 | 3405 | g NOP | 3501 |
| B | 12 | + | 61 | g NOP | 3501 |
| EEX | 43 | $\div$ | 81 | g NOP | 3501 |
| 2 | 02 | 1 | 01 | g NOP | 3501 |
| STO 3 | 3303 | - | 51 | g NOP | 3501 |
| $\mathrm{g} \mathrm{R} \downarrow$ | 3508 | 2 | 02 | g NOP | 3501 |
| STO 4 | 3304 | 0 | 00 | g NOP | 3501 |
| RTN | 24 | 0 | 00 | g NOP | 3501 |
| LBL | 23 | x | 71 | g NOP | 3501 |
| C | 13 | RCL 1 | 3401 | g NOP | 3501 |
| STO 5 | 3305 | CHS | 42 | g NOP | 3501 |
| RTN | 24 | $\div$ | 81 | g NOP | 3501 |
| LBL | 23 | STO 2 | 3302 | g NOP | 3501 |
| D | 14 | RTN | 24 | g NOP | 3501 |
| STO 3 | 3303 | g NOP | 3501 | g NOP | 3501 |
| RTN | 24 | g NOP | 3501 | g NOP | 3501 |
| LBL | 23 | g NOP | 3501 | g NOP | 3501 |
| E | 15 | g NOP | 3501 | g NOP | 3501 |
| 1 | 01 | g NOP | 3501 | g NOP | 3501 |
| RCL 1 | 3401 | g NOP | 3501 | g NOP | 3501 |
| g | 35 | g NOP | 3501 | g NOP | 3501 |
| ABS | 06 | g NOP | 3501 | g NOP | 3501 |
| $g x>y$ | 3524 | g NOP | 3501 | g NOP | 3501 |
| 0 | 00 | g NOP | 3501 | g NOP | 3501 |
| $\div$ | 81 | g NOP | 3501 |  |  |
| RCL 3 | 3403 | g NOP | 3501 |  |  |
| RCL 4 | 3404 | g NOP | 3501 |  |  |
| 2 | 02 | g NOP | 3501 |  |  |
| $\div$ | 81 | g NOP | 3501 |  |  |


| $\mathbf{R}_{\mathbf{1}}$-PER | $\mathbf{R}_{\mathbf{4}}$ CR | $\mathbf{R}_{\mathbf{7}}$ |
| :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ YLD | $\mathbf{R}_{\mathbf{5}}$ PRICE | $\mathbf{R}_{\mathbf{8}}$ |
| $\mathbf{R}_{\mathbf{3}}$ RV | $\mathbf{R}_{\mathbf{6}}$ | $\mathbf{R}_{\mathbf{9}}$ Used |

## ACCRUED SIMPLE INTEREST

| KEYS | CODE |
| :---: | :---: |
| LBL | 23 |
| A | 11 |
| STO 1 | 3301 |
| RTN | 24 |
| LBL | 23 |
| B | 12 |
| $\uparrow$ | 41 |
| $\uparrow$ | 41 |
| EEX | 43 |
| 2 | 02 |
| $\div$ | 81 |
| STO 2 | 3302 |
| $\mathrm{g} \times \underset{\mathrm{F}}{ } \mathrm{y}$ | 3507 |
| RTN | 24 |
| LBL | 23 |
| C | 13 |
| STO 3 | 3303 |
| RTN | 24 |
| LBL | 23 |
| D | 14 |
| RCL 3 | 3403 |
| RCL 3 | 3403 |
| RCL 2 | 3402 |
| x | 71 |
| RCL 1 | 3401 |
| x | 71 |
| 3 | 03 |
| 6 | 06 |
| 0 | 00 |
| $\div$ | 81 |
| RTN | 24 |
| LBL | 23 |
| E | 15 |
| RCL 3 | 3403 |
| RCL 3 | 3403 |


| KEYS | CODE |
| :--- | ---: |
| RCL 2 | 3402 |
| x | 71 |
| RCL 1 | 3401 |
| x | 71 |
| 3 | 03 |
| 6 | 06 |
| 5 | 05 |
| $\vdots$ | 81 |
| RTN | 24 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |


| KEYS | CODE |
| :--- | :--- |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
| g NOP | 3501 |
|  |  |
|  |  |
|  |  |


| $\mathbf{R}_{\mathbf{1}}$ | DAYS | $\mathbf{R}_{\mathbf{4}}$ |
| :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | RATE $/ 100$ | $\mathbf{R}_{\mathbf{5}}$ |
| $\mathbf{R}_{\mathbf{3}}$ | BEG AMT | $\mathbf{R}_{\mathbf{6}}$ |

LINEAR REGRESSION (TREND LINE)

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| f | 31 | RCL 2 | 3402 | X | 71 |
| REG | 43 | RTN | 24 | RCL 5 | 3405 |
| RTN | 24 | LBL | 23 | RCL 8 | 3408 |
| LBL | 23 | D | 14 | CHS | 42 |
| B | 12 | RCL 7 | 3407 | $\div$ | 81 |
| STO 1 | 3301 | RCL 3 | 3403 | + | 61 |
| g | 35 | RCL 5 | 3405 | STO 2 | 3302 |
| DSZ | 83 | x | 71 | RTN | 24 |
| STO | 33 | RCL 8 | 3408 | LBL | 23 |
| + | 61 | $\div$ | 81 | D | 14 |
| 3 | 03 | + | 61 | CLX | 44 |
| $\uparrow$ | 41 | $\uparrow$ | 41 | RCL 1 | 3401 |
| x | 71 | $\uparrow$ | 41 | RTN | 24 |
| STO | 33 | RCL 3 | 3403 | LBL | 23 |
| + | 61 | $\uparrow$ | 41 | D | 14 |
| 4 | 04 | X | 71 | $\mathrm{g} R \uparrow$ | 3509 |
| RCL 1 | 3401 | RCL 8 | 3408 | RTN | 24 |
| RTN | 24 | $\div$ | 81 | LBL | 23 |
| LBL | 23 | RCL 4 | 3404 | E | 15 |
| C | 13 | + | 61 | RCL 1 | 3401 |
| STO 2 | 3302 | $\div$ | 81 | $\times$ | 71 |
| STO | 33 | STO 1 | 3301 | RCL 2 | 3402 |
| + | 61 | $\times$ | 71 | + | 61 |
| 5 | 05 | RCL 5 | 3405 | RTN | 24 |
| $\uparrow$ | 41 | $\uparrow$ | 41 | g NOP | 3501 |
| x | 71 | x | 71 | g NOP | 3501 |
| STO | 33 | RCL 8 | 3408 | g NOP | 3501 |
| + | 61 | $\div$ | 81 | g NOP | 3501 |
| 6 | 06 | RCL 6 | 3406 | g NOP | 3501 |
| g LST X | 3500 | + | 61 | g NOP | 3501 |
| RCL 1 | 3401 | $\div$ | 81 |  |  |
| x | 71 | RCL 3 | 3403 |  |  |
| STO | 33 | RCL 8 | 3408 |  |  |
| + | 61 | $\div$ | 81 |  |  |
| 7 | 07 | RCL 1 | 3401 |  |  |


| $\mathbf{R}_{\mathbf{1}} \mathrm{x}, \mathrm{m}$ | $\mathbf{R}_{\mathbf{4}} \Sigma \mathrm{x}^{\mathbf{2}}$ | $\mathbf{R}_{\mathbf{7}} \quad \Sigma \mathrm{xy}$ |
| :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}} \mathrm{y}, \mathrm{b}$ | $\mathbf{R}_{\mathbf{5}} \Sigma \mathrm{y}$ | $\mathbf{R}_{\mathbf{8}}-\mathrm{n}$ |
| $\mathbf{R}_{\mathbf{3}} \Sigma \mathrm{x}$ | $\mathbf{R}_{\mathbf{6}} \Sigma \mathrm{y}^{2}$ | $\mathbf{R}_{\mathbf{9}}$ |

## EXPONENTIAL CURVE FIT (GROWTH CURVE)

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| f | 31 | + | 61 | $\div$ | 81 |
| REG | 43 | 7 | 07 | RCL 1 | 3401 |
| RTN | 24 | RCL 2 | 3402 | x | 71 |
| LBL | 23 | RTN | 24 | RCL 5 | 3405 |
| B | 12 | LBL | 23 | RCL 8 | 3408 |
| STO 1 | 3301 | D | 14 | CHS | 42 |
| g | 35 | RCL 7 | 3407 | $\div$ | 81 |
| DSZ | 83 | RCL 3 | 3403 | + | 61 |
| STO | 33 | RCL 5 | 3405 | $\mathrm{f}^{-1}$ | 32 |
| + | 61 | X | 71 | LN | 07 |
| 3 | 03 | RCL 8 | 3408 | STO 2 | 3302 |
| $\uparrow$ | 41 | $\div$ | 81 | RTN | 24 |
| x | 71 | + | 61 | LBL | 23 |
| STO | 33 | $\uparrow$ | 41 | D | 14 |
| + | 61 | $\uparrow$ | 41 | CLX | 44 |
| 4 | 04 | RCL 3 | 3403 | RCL 1 | 3401 |
| RCL 1 | 3401 | $\uparrow$ | 41 | RTN | 24 |
| RTN | 24 | x | 71 | LBL | 23 |
| LBL | 23 | RCL 8 | 3408 | D | 14 |
| C | 13 | $\div$ | 81 | $\mathrm{g} R \uparrow$ | 3509 |
| STO 2 | 3302 | RCL 4 | 3404 | RTN | 24 |
| f | 31 | + | 61 | LBL | 23 |
| LN | 07 | $\div$ | 81 | E | 15 |
| STO | 33 | STO 1 | 3301 | RCL 1 | 3401 |
| + | 61 | $\times$ | 71 | x | 71 |
| 5 | 05 | RCL 5 | 3405 | $\mathrm{f}^{-1}$ | 32 |
| $\uparrow$ | 41 | $\uparrow$ | 41 | LN | 07 |
| x | 71 | X | 71 | RCL 2 | 3402 |
| STO | 33 | RCL 8 | 3408 | $\times$ | 71 |
| + | 61 | $\div$ | 81 | RTN | 24 |
| 6 | 06 | RCL 6 | 3406 |  |  |
| g LST X | 3500 | + | 61 |  |  |
| RCL 1 | 3401 | $\div$ | 81 |  |  |
| x | 71 | RCL 3 | 3403 |  |  |
| STO | 33 | RCL 8 | 3408 |  |  |


| $\mathbf{R}_{\mathbf{1}} \quad \mathrm{x}, \mathrm{m}$ | $\mathbf{R}_{\mathbf{4}} \quad \Sigma \mathrm{x}^{2}$ | $\mathbf{R}_{\mathbf{7}}$ | $\Sigma \times \ln y$ |  |
| :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}} \mathrm{y}, \mathrm{b}$ | $\mathbf{R}_{\mathbf{5}}$ | $\Sigma \ln y$ | $\mathbf{R}_{\mathbf{8}}$ | -n |
| $\mathbf{R}_{\mathbf{3}} \quad \Sigma \mathrm{x}$ | $\mathbf{R}_{\mathbf{6}} \quad \Sigma(\operatorname{lny})^{2}$ | $\mathbf{R}_{\mathbf{9}}$ |  |  |

TOTAL, AVERAGE, AND PERCENT OF TOTAL (UP TO 8 ITEMS)

| KEYS | CODE |
| :---: | :---: |
| f | 31 |
| REG | 43 |
| 9 | 09 |
| STO 8 | 3308 |
| CLX | 44 |
| RTN | 24 |
| LBL | 23 |
| D | 14 |
| C | 13 |
| 9 | 09 |
| RCL 8 | 3408 |
| - | 51 |
| $\div$ | 81 |
| RTN | 24 |
| LBL | 23 |
| B | 12 |
| RCL 1 | 3401 |
| $\mathrm{g} \times \overrightarrow{\mathrm{k}} \mathrm{y}$ | 3507 |
| STO 1 | 3301 |
| $\mathrm{g} \times \vec{\leftarrow} \mathrm{y}$ | 3507 |
| RCL 2 | 3402 |
| $\mathrm{g} \times \overrightarrow{\mathrm{k}} \mathrm{y}$ | 3507 |
| STO 2 | 3302 |
| gx y y | 3507 |
| RCL 3 | 3403 |
| $\mathrm{gx} \times \mathrm{y}$ | 3507 |
| STO 3 | 3303 |
| $\mathrm{g} \times \overrightarrow{\mathrm{F}} \mathrm{y}$ | 3507 |
| RCL 4 | 3404 |
| $\mathrm{gx} \overrightarrow{\mathrm{y}}$ | 3507 |
| STO 4 | 3304 |
| $\mathrm{g} \times \overrightarrow{\mathrm{k}}$ | 3507 |
| RCL 5 | 3405 |
| $\mathrm{g} \times \overrightarrow{\mathrm{z}} \mathrm{y}$ | 3507 |
| STO 5 | 3305 |


| KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: |
| $\mathrm{g} \times \overrightarrow{\mathrm{F}} \mathrm{y}$ | 3507 | + | 61 |
| RCL 6 | 3406 | RCL | 34 |
| $\mathrm{g} \times \stackrel{y}{ }$ | 3507 | 9 | 09 |
| STO 6 | 3306 | + | 61 |
| $\mathrm{g} \times \overrightarrow{\mathrm{k}} \mathrm{y}$ | 3507 | RTN | 24 |
| RCL 7 | 3407 | LBL | 23 |
| STO | 33 | E | 15 |
| 9 | 09 | RCL | 34 |
| $\mathrm{g} \times \overrightarrow{\mathrm{F}} \mathrm{y}$ | 3507 | 9 | 09 |
| STO 7 | 3307 | B | 12 |
| 1 | 01 | 1 | 01 |
| 0 | 00 | STO | 33 |
| RCL 8 | 3408 | + | 61 |
| - | 51 | 8 | 08 |
| g | 35 | 9 | 35 |
| DSZ | 83 | DSZ | 83 |
| RTN | 24 | GTO | 22 |
| g NOP | 3501 | E | 15 |
| 0 | 00 | 1 | 01 |
| STO 8 | 3308 | STO 8 | 3308 |
| RTN | 24 | RCL 1 | 3401 |
| LBL | 23 | RCL 1 | 3401 |
| C | 13 | C | 13 |
| RCL 1 | 3401 | $\div$ | 81 |
| RCL 2 | 3402 | EEX | 43 |
| + | 61 | 2 | 02 |
| RCL 3 | 3403 | x | 71 |
| + | 61 | RTN | 24 |
| RCL 4 | 3404 | g NOP | 3501 |
| + | 61 | g NOP | 3501 |
| RCL 5 | 3405 |  |  |
| + | 61 |  |  |
| RCL 6 | 3406 |  |  |
| + | 61 |  |  |
| RCL 7 | 3407 |  |  |


| $\mathbf{R}_{\mathbf{1}} \times$ | $\mathbf{R}_{\mathbf{4}} \times$ | $\mathbf{R}_{\mathbf{7}} \times$ |  |
| :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}} \times$ | $\mathbf{R}_{\mathbf{5}} \times$ | $\mathbf{R}_{\mathbf{8}}$ | Used |
| $\mathbf{R}_{\mathbf{3}} \times$ | $\mathbf{R}_{\mathbf{6}} \times$ | $\mathbf{R}_{\mathbf{9}} \times$ |  |

MOVING AVERAGES

| KEYS | CODE |
| :---: | :---: |
| LBL | 23 |
| B | 12 |
| RCL 1 | 3401 |
| $\mathrm{g} \mathrm{x} \vec{y}$ | 3507 |
| STO 1 | 3301 |
| $\mathrm{g} \mathrm{x} \vec{y}$ | 3507 |
| RCL 2 | 3402 |
| $\mathrm{g} \mathrm{x} \overrightarrow{\mathrm{F}}$ | 3507 |
| STO 2 | 3302 |
| $\mathrm{g} \mathrm{x} \overrightarrow{\mathrm{y}}$ | 3507 |
| RCL 3 | 3403 |
| $\mathrm{g} \mathrm{x} \overrightarrow{\mathrm{F}}$ | 3507 |
| STO 3 | 3303 |
| $\mathrm{g} \mathrm{x} \overrightarrow{\mathrm{F}}$ | 3507 |
| RCL 4 | 3404 |
| $\mathrm{g} \times \overrightarrow{\mathrm{F}} \mathrm{y}$ | 3507 |
| STO 4 | 3304 |
| $\mathrm{g} \times \overrightarrow{\mathrm{F}} \mathrm{y}$ | 3507 |
| RCL 5 | 3405 |
| $\mathrm{g} \times \overrightarrow{\mathrm{H}} \mathrm{y}$ | 3507 |
| STO 5 | 3305 |
| $\mathrm{g} \times \overrightarrow{\mathrm{F}} \mathrm{y}$ | 3507 |
| STO 6 | 3306 |
| g | 35 |
| DSZ | 83 |
| RCL 8 | 3408 |
| CHS | 42 |
| RTN | 24 |
| LBL | 23 |
| A | 11 |
| f | 31 |
| REG | 43 |
| STO 7 | 3307 |
| RTN | 24 |
| LBL | 23 |


| KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: |
| C | 13 | $\div$ | 81 |
| RCL 7 | 3407 | LBL | 23 |
| 6 | 06 | 1 | 01 |
| $\mathrm{g} x=y$ | 3523 | RCL 1 | 3401 |
| GTO | 22 | RCL 2 | 3402 |
| 1 | 01 | + | 61 |
| CLX | 44 | RCL 3 | 3403 |
| STO 6 | 3306 | + | 61 |
| CLX | 44 | RCL 4 | 3404 |
| 5 | 05 | + | 61 |
| $\mathrm{g} x=y$ | 3523 | RCL 5 | 3405 |
| GTO | 22 | + | 61 |
| 1 | 01 | RCL 6 | 3406 |
| CLX | 44 | + | 61 |
| STO 5 | 3305 | RCL 7 | 3407 |
| CLX | 44 | $\div$ | 81 |
| 4 | 04 | RTN | 24 |
| $\mathrm{g} \mathrm{x}=\mathrm{y}$ | 3523 | LBL | 23 |
| GTO | 22 | D | 14 |
| 1 | 01 | LBL | 23 |
| CLX | 44 | E | 15 |
| STO 4 | 3304 | 0 | 00 |
| CLX | 44 | $\div$ | 81 |
| 3 | 03 | RTN | 24 |
| $\mathrm{g} \mathrm{x}=\mathrm{y}$ | 3523 | g NOP | 3501 |
| GTO | 22 | g NOP | 3501 |
| 1 | 01 | g NOP | 3501 |
| CLX | 44 | g NOP | 3501 |
| STO 3 | 3303 | g NOP | 3501 |
| CLX | 44 | g NOP | 3501 |
| 2 | 02 |  |  |
| $\mathrm{g} x=y$ | 3523 |  |  |
| GTO | 22 |  |  |
| 1 | 01 |  |  |
| 0 | 00 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | $x_{k}$ | $\mathbf{R}_{\mathbf{4}}$ | $\mathbf{x}_{\mathrm{k}-3}$ | $\mathbf{R}_{\mathbf{7}}$ | \# |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $x_{k-1}$ | $\mathbf{R}_{\mathbf{5}}$ | $\mathbf{x}_{\mathrm{k}-\mathbf{4}}$ | $\mathbf{R}_{\mathbf{8}}$ | -k |
| $\mathbf{R}_{\mathbf{3}}$ | $x_{k-2}$ | $\mathbf{R}_{\mathbf{6}}$ | $x_{k-5}$ | $\mathbf{R}_{\mathbf{9}}$ | Used |

## INVOICING

| KEYS | CODE | KEYS | CODE | KEYS | CODE |
| :---: | :---: | :---: | :---: | :---: | :---: |
| LBL | 23 | + | 61 | g NOP | 3501 |
| A | 11 | 4 | 04 | g NOP | 3501 |
| CLX | 44 | STO | 33 | g NOP | 3501 |
| STO 1 | 3301 | + | 61 | g NOP | 3501 |
| STO 2 | 3302 | 5 | 05 | g NOP | 3501 |
| STO 3 | 3303 | RTN | 24 | g NOP | 3501 |
| STO 4 | 3304 | LBL | 23 | g NOP | 3501 |
| STO 5 | 3305 | E | 15 | g NOP | 3501 |
| RTN | 24 | RCL 4 | 3404 | g NOP | 3501 |
| LBL | 23 | RTN | 24 | g NOP | 3501 |
| B | 12 | LBL | 23 | g NOP | 3501 |
| STO 1 | 3301 | E | 15 | g NOP | 3501 |
| RTN | 24 | CLX | 44 | g NOP | 3501 |
| LBL | 23 | STO 4 | 3304 | g NOP | 3501 |
| C | 13 | RTN | 24 | g NOP | 3501 |
| STO 2 | 3302 | LBL | 23 | g NOP | 3501 |
| RTN | 24 | E | 15 | g NOP | 3501 |
| LBL | 23 | RCL 5 | 3405 | g NOP | 3501 |
| D | 14 | RTN | 24 | g NOP | 3501 |
| STO 3 | 3303 | g NOP | 3501 | g NOP | 3501 |
| RTN | 24 | g NOP | 3501 | g NOP | 3501 |
| LBL | 23 | g NOP | 3501 | g NOP | 3501 |
| E | 15 | g NOP | 3501 | g NOP | 3501 |
| RCL 2 | 3402 | g NOP | 3501 | g NOP | 3501 |
| RCL 3 | 3403 | g NOP | 3501 | g NOP | 3501 |
| x | 71 | g NOP | 3501 | g NOP | 3501 |
| $\uparrow$ | 41 | g NOP | 3501 | g NOP | 3501 |
| $\uparrow$ | 41 | g NOP | 3501 | g NOP | 3501 |
| RCL 1 | 3401 | g NOP | 3501 | g NOP | 3501 |
| EEX | 43 | g NOP | 3501 | g NOP | 3501 |
| 2 | 02 | g NOP | 3501 |  |  |
| $\div$ | 81 | g NOP | 3501 |  |  |
| x | 71 | g NOP | 3501 |  |  |
| - | 51 | g NOP | 3501 |  |  |
| STO | 33 | g NOP | 3501 |  |  |


| $\mathbf{R}_{\mathbf{1}}$ | DISC | $\mathbf{R}_{\mathbf{4}}$ | SUB-TOT | $\mathbf{R}_{\mathbf{7}}$ |
| :--- | :--- | :--- | :--- | :--- |
| $\mathbf{R}_{\mathbf{2}}$ | $\#$ | $\mathbf{R}_{\mathbf{5}}$ | GRAND TOTAL | $\mathbf{R}_{\mathbf{8}}$ |
| $\mathbf{R}_{\mathbf{3}}$ | PRICE | $\mathbf{R}_{\mathbf{6}}$ |  | $\mathbf{R}_{\mathbf{9}}$ |

## HEWLETT hp PACKARD

Sales and service from 172 offices in 65 countries. 19310 Pruneridge Avenue, Cupertino, California 95014


[^0]:    *If only the balloon payment is to be calculated, program 4 should be used.

