TDS

Financial Functions Library

TABLE OF CONTENTS

===

1. INTRODUCTION

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In this chapter, you will become
familiar with the features of the
TDS Financial Functions Library.
You will learn how to install the
program and how to back it up and
run it.

WELCOME TO THE TDS FINANCIAL FUNCTIONS LIBRARY

The TDS Financial Functions Library is a software package
designed to run on the HP-48SX Scientific Expandable Calculator
from Hewlett-Packard. With the introduction of the 48SX,
Hewlett-Packard has provided a machine for the '90s which can
have the kind of impact that the HP-41 series of products had in
the '80s. The HP-48SX is the "spiritual" successor of the HP-
41CX in that it is designed in the vertical format; it accepts
ROM and RAM plug-in cards; and, it allows for data exchange with
other computing devices. However, the 48SX is the "logical"
successor to the HP-28S, in that its programming language is a
superset of the 28S version of object oriented RPN. Programs
written to run on the 28S, once keyed into the 48SX, will run
compatibly. Programs written to run on the 41 will not run on the
48SX directly.

The HP-48SX has significantly more computational capability than
previous HP scientific calculator products. Indeed, it is
unlikely that any single user will require or need to learn all
of the features of the machine. One of the major distinctions of
the 48 is that it is possible to plug in an application card and
to alter temporarily the nature of the machine. A well designed
application can take advantage of all of the hardware features of
the 48 without requiring you, the user, to master the intricacies
of the machine. This is the objective of the TDS Financial
Functions Library. It is possible to learn and use all of the
features of the Financial Functions Library without learning any
of the capabilities of the 48SX itself. Indeed, you do not even
have to open the 48 manuals. However, the Financial Functions
Library is designed so that its capabilities may be integrated
with your own calculations if you are a skilled user of the 48.

BASIC FUNCTIONAL CAPABILITIES OF THE LIBRARY

The TDS Financial Functions Library contains the following basic
capabilities:

1) Time Value of Money Calculations - This is the classic "five
variable" TVM problem for simple installment loans. The
variables are: present value (PV), future value (FV), number of
payments (n), interest rate (i), and payment amount (PMT). The
problem is: given any four variables, solve for the fifth. The

TDS Financial Functions Library takes advantage of the large
screen and "softkey" design of the 48 to show the entire problem
in the screen at the same time. Once the problem has been
solved, the TDS Financial Functions Library can be used to
compute an amortization schedule for the loan and print it on the
HP-82240B Infrared Printer.

2) Markup Calculations - This is the ability to compute markups
and discounts based on price or cost. This capability also
includes the ability to compute percents of change and percents
of totals.

3) Discounted Cash Flow Analysis - Discounted cash flow analysis
involves a two-step process. First, you must specify cash flows
over time. These may be unequal amounts, but the time intervals
must be the same. A sequence of equal cash flows may be
expressed as a "group" of cash flows. Once the cash flow list
has been established, you may solve for either the net present
value (NPV), the net future value (NFV), the net uniform series
(NUS) or the internal rate of return (IRR).

4) Interest Rate Conversions - This is the ability to convert
between nominal and effective interest rates.

5) Depreciation Calculations - This is the ability to perform
depreciation calculations for an asset using any of three
depreciation methods.

INSTALLING THE LIBRARY

If your Library is in ROM, installing it is as simple as
inserting the ROM Card into an open port on your 48 and running
the software. See below: Running the Library.

Be certain that you have three AAA alkaline battery cells
properly installed in your HP-48SX before you begin the card
installation process.

==>NOTE: Throughout this manual, keystrokes to use in
   implementing the various procedures are shown in enclosed
   in brackets [ ] indicates actual keys on the HP-48SX.
   These may be either printed directly on a keytop or
   temporarily shown in the bottom line of the display as
   a "softkey" label. Keystroke enclosed in brackets [ ]
   and preceded by either a [left-shift] or a [right-shift]
   indicates that the named function is a "left"- or "right"
   -shifted function and that name may be found printed on the
   keyboard above one of the keytops. Upper case keystrokes
   that is not enclosed in brackets indicates that the
   message should be keyed into the command line of the 48 as
   an alpha string, preceded by the usual [alpha] [alpha]
   alpha-lock keystrokes. Lower case keystrokes that is
   enclosed in braces { } indicates that the value

to be keyed in may vary depending on your unique situation.
A further explanation of what is required is provided
in braces { } on the appropriate line in the manual.

1) Turn your HP-48SX OFF [right-shift] [ON].

2) Remove your port cover and make sure that you have an empty
port. If you do not have an empty port, you will have to remove
one of the cards you have installed. (This will cause a system
memory loss if you remove plug-in RAM and it has been configured
as part of your main system RAM).

3) Position the card in the slot with the triangular arrow
showing Make sure that the end of the card with the arrow printed
on it is inserted first. Be certain that both edges of the
card are in the same port slot.

4) Slide the card firmly into place until it stops.   When you
first feel resistance, it still has 6 mm (about 1/4") to go
before it is fully seated.

The installation is now complete. Replace your port cover and
turn your HP-48SX back [ON].

RUNNING THE TDS FINANCIAL FUNCTIONS LIBRARY

Once the TDS Financial Functions Library has been properly
installed, you may run it by pressing:

[a] [a] TDSFIN [ENTER].   ([a] is the [alpha] key)

The copyright notice will be displayed briefly, and then you will
see the product's Main Menu:

                    <Select [G] to [K]>
            [G] Time value - money
            [H] Markup
            [I] Cash flow
            [J] Interest conver
            [K] Depreciation
                                [EXIT]

EXITING FROM THE TDS FINANCIAL FUNCTIONS LIBRARY

In the Main Menu, you will notice that the softkey above the [F]
key is labeled [EXIT]. To exit from the Library and return to
the system, merely press the key associated with this label.
You will be prompted with a message asking if you are sure that
you want to leave the program. To respond positively to this
prompt, press [Y] (for Yes). Control will now be returned to the
main HP-48SX operating system.

HOW TO LEARN THE SYSTEM AND HOW TO USE THIS MANUAL

The best way to learn the TDS Financial Functions Library is just
to sit down and use it. You will find the user interface to be
very intuitive and easy to master. This is due primarily to the
consistency within the product. The Library utilizes a combined
"Menu" and "Screen" user interface. Screens make appropriate use
of the HP-48SX's softkeys. These six keys across the top of the
keyboard are defined as is appropriate to each job.   The
definitions of these keys are always shown in the bottom row of
the 48's display. After you've learned a few "rules of the road"
(Chapter 2), the most efficient way to master any feature is to
go ahead and press the keys and see what happens. You can't hurt
the 48.

This User's Manual is organized as follows:

Chapter 2, "Getting Started", gives an overview of the Menu and
Screen   user interface and explains the basic   terms   and
conventions used throughout the product.

Chapters 3 through 7 give detailed instructions with example
problems for each of the five main functional categories of the
product.   At the end of each of these chapters, there is a
section that presents each of the screens encountered in that
chapter in a summary format for reference.

Finally, Appendix A provides a listing of the equations used
throughout the product.

2. GETTING STARTED
==

>   In this chapter, you will start to use
>   your TDS FINANCIAL FUNCTIONS LIBRARY.
>   You will learn how the features and
>   functions in the Library are organized
>   and how to access them. Finally, you
>   will learn the various terms and conventions
>   associated with the product.

BEFORE YOU START

Before you start, you should be certain that you have properly
installed in your TDS Financial Functions Library. For
installation instruction, see Chapter 1 - Introduction.

THE RULES OF THE ROAD

Now press the [ON] key. You will see the operational stack of
the standard HP-48SX operating system displayed as:

```
        +---------------------+
        | {HOME}              |
        |---------------------|
        |                     |
        |4:                   |
        |3:                   |
        |2:                   |
        |1:                   |
        +---------------------+
        [ ][ ][ ][ ][ ][ ]
```

Now press [a] [a] [T] [D] [S] [F] [I] [N] [ENTER].
The TDS Financial Functions Library has now taken over
control of the machine. You will see the MAIN MENU of the
product which looks like:

```
        <Select [G] to [K]>
        [G] Time value -momey
        [H] Mark up
        [I] Cash flow
        [J] Interest conver
        [K] Depreciation
                            [EXIT]
```

Now press the [left-shift] and [ON] keys.   As you probably
already know, you access the functions printed in gold above the
keys by pressing the gold shift key [left-shift] before   the
appropriate key. Likewise, you access the functions printed in
blue above the keys by pressing the blue shift key [right-shift]
before   the   appropriate key. In this case, pressing [right-
shift] prior to pressing [ON] will execute [OFF].

Now press [ON] again. Notice that you return to the Main Menu.
This is where you were when you turned the unit OFF. This is the
first Rule of the Road: When you turn the TDS Financial
Functions Library ON, you will return to the screen or menu
location occupied when you turned the machine OFF.

The six boxes at the bottom of the display screen are called
"soft" key labels. They identify the functions of the six keys
in the top row of the keyboard. Pressing any one of these keys
will activate the function shown in the box above that key in the
bottom row of the screen. The functions will change depending
on the particular screen that you are using and the problem that
you are solving.

MENUS VS. SCREENS - WHAT'S THE DIFFERENCE?

The TDS Financial Functions are intuitive to use. Much progress
can be made in mastering its system by pressing keys and seeing
what happens in response. However, full understanding of the
machine requires that a few simple concepts be well understood.
One of these is the difference between a MENU and a SCREEN.   A
MENU is a display that is characterized by a list of functions or
operations which may be selected by choosing one of   the
alphabetic keys listed down the left hand column of the display.
Except for the [EXIT] key, MENUS do not use active "soft" keys.
The [EXIT] key is always labeled above the [F] key on the right.
Pressing one of the alpha keys shown in the MENU display will
present you with either another MENU (with more alpha choices and
an [EXIT] key) or a SCREEN.

The [EXIT] key will always return to the SCREEN or MENU location
occupied prior to a current SCREEN or MENU. Thus, MENUS in the
Financial Functions Library are arranged like a "tree".   By
selecting a sequence of alpha keys, you make progress from the
MAIN MENU (the trunk of the tree) to the large branches
(additional menus) and then to the small branches (screens).   By
pressing [EXIT] successively, you can progress back through the
branches to the trunk (the MAIN MENU).

As an example of how this works, consider the Markup Menu. From
the Main Menu press [H]. This will present you with another
Menu, the Markup Menu:

                  Markup
          [G] Markup on cost
          [H] Markup on price
          [I] Percent change
          [J] Percent of total

                        [EXIT]

Now press [G]. You will now see your first "Screen":

```
                Markup on cost
           Cost:         0.00
           Price:        0.00
           MU on cost: 0.000 %

           [MU%C][COST][PRICE]  [EXIT]
```

Screens are where you actually key in your known information and,
in conjunction with the softkey definitions, you will solve your
problems.   You will practice with this screen in Chapter 4. Now
press the [EXIT] softkey twice. Pause each time to notice how
the Financial Functions Library returns to the previous MENU in
the MENU "tree". Finally, you arrive back at the first display
of the MAIN MENU.

       ==> NOTE: In the HP-48SX, the top row of keys are used
           for the alpha keys A - F, as well as for the softkeys.
           For this reason, all Menu labels in the Financial
           functions Library begin with the letter [G].
           Since there is no ambiguity in MENUS between menu
           selection keys and softkeys, it is not necessary to
           press the [a] key prior to making a menu screen selection.

SCREENS

From the MAIN MENU, press [G]; and you will see the Time Value of
Money Screen. A screen is characterized by labels and data on
each of the lines of the display separated by colons and by a
variety of "soft" key labels at the bottom. These "soft" keys
give you several options of functions to perform. It is in the
screens where you will enter your data and solve your financial
problems. While the user interface among the various screens is
consistent, each screen solves a different kind of problem. Each
screen is explained in detail in the chapters which follow. This
is another rule of the road.You don't solve problems in the
menus.   The menus are just an aid to help you navigate the
various screens.

To understand some important properties of all screens, you will
study the Time Value of Money Screen in more detail now.

The Time Value of Money Screen appears as:

```
           No. of payments:  0
           Annual int.:  0.000 %
           Pr. value:      0.00
           Payment:        0.00
           Fu. value:      0.00
           No. of pmts/yr:  12
           Payment mode:  >End

           [N][I%YR][PV][PMT][FV][OTHER]
```

You will use this screen to solve your first financial problem
and, at the same time, learn some other very important concepts
or Rules of the Road. The first has to do with the uses of the
vertical cursor keys [^] and [v]. When you first enter this
screen, the value of the number of payments is highlighted by a
scroll bar. By pressing one of these vertical cursor keys, you
will move the scroll bar to the next data entry field. The [^]
key moves the scroll bar up in the screen. The [v] key moves
the scroll bar down in the screen. The procedure for solving any
screen is to place the scroll bar at each data entry field as
defined in the screen; key in the appropriate value; and, press
the proper solution softkey. As an example: suppose you are
about to take out a home loan in the amount of $75,000. The term
of the loan is 25 years and the annual interest rate is 9.25%.
What will be the monthly payment required to fully amortize the
loan?

The first five lines of this screen represent the five variables
in this classic problem: the number of payments; the annual
interest rate; the present value (initial loan amount); the
periodic (monthly, in this case) payment; and the future value
(balloon payment, if any, at the end of the term of the loan).
The procedure for solving this problem is to use the vertical
cursor keys to move the scroll bar to each line for which you know
information and key in the information that you know.   Then,
press the softkey that is labeled with the variable that you
don't know. That unknown value will be computed and displayed at
the proper line of the screen.

For this example, key in 300 (the number of months in 25 years)
in the top line; move the scroll bar to the Annual interest line
and key in 9.25; move to the Pr. value line and key in 75000; use
the scroll bar to skip over the Payment line and key in 0.00 (if
it's not already zero) in the Fu value line.

        ==> NOTE:Pressing [ENTER] after keying each known
            value will cause that value to be entered and
            the scroll bar will drop to the next input line.

The last two lines of the screen represent parameters that will
affect the solution of the problem, but ones that you cannot
solve for.   The first is the number of payments that you will
make per year; in this case 12. The last line is where you
indicate whether payments are to be made at the beginning or at
the end of each period. To see how you make this selection, move
the scroll bar to the last line in the screen. Notice that to
the right of the colon in this line of the display there is a ">"
symbol. Whenever this symbol appears in a screen line, it is an
indication that you have a restricted choice of   options
available.   To see the choices, press one of the horizontal
cursor keys. You will scroll horizontally through the list of
choices. In this case there are only two choices: Begin or End.
For this example choose End.

This is another rule of the road. Select from a list of
restricted choices (a line with a ">" symbol) by using one of the
horizontal cursor keys [right-shift] or [left-shift].
Properly filled out, your screen should now look like:

                No. of payments: 300
                Annual int.: 9.250 %
                Pr. value: 75000.00
                Payment: 0.00
                Fu. value: 0.00
                No. of pmts/yr: 12
                Payment mode: >End

        [N][I%YR][PV][PMT][FV][OTHER]

You are now ready to solve for the monthly payment. Press the
[PMT] softkey. The answer, -642.29, is shown in the payment line
of the screen. [For now ignore the fact that the value is shown
with a negative sign. The reason for this will be explained
later in this chapter.] Thus, for the loan in question, the
monthly payment will be $642.29.

GLOBAL TOP-ROW KEYBOARD FUNCTIONS

In addition to the six softkeys whose functions change depending
on the screen that is active, there are three Global Keys that
you access with the gold shift key and three of the keys in the
top row. They are the keystrokes [left-shift] [A], [right-shift]
[D], and [left-shift][F]. the functions they perform are [ESC],
[PRINT], and [MAIN], respectively. These functions are
described briefly below:

[ESC] - [left-shift][A] The [ESC] (Escape) functions may only be
executed from a SCREEN. When you are in a screen and you press
[ESC] - ([left-shift][A]), control of the system is passed
temporarily from the Library to the operating system of the 48SX.
In addition, the numerical value of the screen at the screen
cursor location is loaded in the operational stack at level 1.
The word "HALT" appears in the annunciator line at the top of the
screen to indicate that a running program has been halted.
Thus, it is now possible for you to perform any calculations that
you want in the stack, including calculations on the value that
has been returned. This can be either manually from the keyboard
or via other software routines which you may have written and
loaded into the system memory. When you are finished and wish to
return to the Financial Functions Library, press [left-shift]
[CONT]. You will return to the screen you were in before
executing [ESC]. When you return, the value at the cursor
location is replaced by the value in level 1 of the stack.

[PRINT] - [left-shift][D]. The [PRINT] function will allow you
to print the current contents of the screen onto the HP-82240B
Infrared Printer. This function may be accessed from any screen

or menu in the Financial Functions Library at any time that you want a hard copy of your work.

[MAIN] - [left-shift][F]. The [MAIN] function will allow you to return to the MAIN MENU from any other menu or screen in the Financial Functions Library. It is a shortcut method of returning to the Main Menu "home base" without pressing [EXIT] repeatedly as described above.

CASH FLOW DIAGRAMS AND SIGN CONVENTIONS

In solving many time value of money problems, it is helpful to draw a cash flow diagram. A cash flow diagram is an horizontal line that represents the passage of time with equally spaced points along the line where cash transactions occur (cash flows). Vertical lines with arrows indicate the relative magnitude and directions of the cash flows. Money received is shown with upward facing arrows; money paid out with downward facing arrows. A cash flow diagram of the above sample problem is shown here:

```
      loan (+)
       ^                         1
       |                         month
       |                         payment
       |                         interval
       |                         ->|   |<-
       |                           |   |
  ---------------------|   |---------------------
     | | | | | |         | | | | | | |
     | | | | | |         | | | | | | |
     v v v v v v         v v v v v v v

      <<--------  300 payments(-) -------->>
```
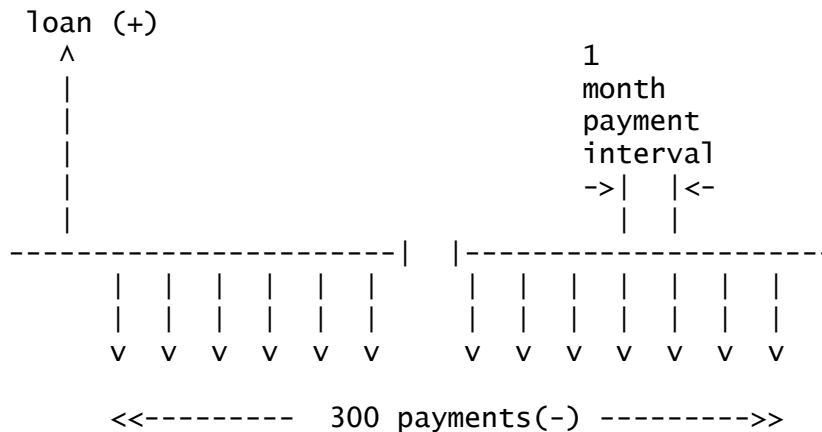
This explains why the value computed for the payment in the above example, -642.29 is shown with a negative sign. The present value, $75,000, flowed to you,the borrower. The payments, $642.29, flowed from you.

    ==> NOTE: The use of the correct sign (+ or -)
        for values in time value of money problems is
        critical. The calculations will only be correct
        if care is taken in setting up the problem with
        the proper sign (direction) of each cash flow.
        Problems may be set up and solutions generated
        from the point of view of the lender or the borrower,
        but the viewpoint must be consistent throughout
        the working of the problem.

3. TIME VALUE OF MONEY

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In this chapter, you will study the
screens associated with the Time
Value of Money capabilities of the
Financial Functions Library.

TIME VALUE OF MONEY

Time Value of Money describes a class of financial cash flow
problems where periodic financial transactions take place and the
money is working (i.e. earning compound interest) during the time
periods described by the problem. In its most generalized form,
a time value of money problem (sometimes abbreviated TVM)
consists of an initial payment (the present value), a series of
periodic payments (the payments); and, a settlement at the end
(the future value).

There are three conditions which must be met for your TVM problem
to be solved with the TVM Screen of the Financial Functions
Library:

  1) All periodic payments must be equal.
  2) All payment intervals must be equal.
  3) The payment periods must correspond to the
     compounding periods.

      ==> NOTE: Problems for which the periodic payment
          amounts may be solved in the Cash Flow Screen.

The problem consists of five variables, three of which are listed
above.   The other two variables are the periodic interest rate
and the total number of periodic payments. If any four of these
variables are known, the Financial Functions Library will solve
for the unknown one.

There are numerous practical situations that fit the constraints
of this solution. Several of them are described and solved in
the example problems which follow. Each problem will be stated;
the cash flow diagram will be shown; the Time Value of Money
Screen will be shown properly set up for the solution; and, the
solution will be given.

EXAMPLE #1 - A SAVINGS ACCOUNT

The problem: You open a savings account with $100. You plan to
deposit $50/month on a regular basis. The annual interest rate
is 6.75%. How much money will you have after two years?
How long will it take you to save $2000?

The cash flow diagram is:

```
                                                    future
                                                    value
                                                      ^
                                                      |
                                          deposit     |
                                          interval    |
                                          ->|   |<-   |
                                            |   |     |
     ----------------------------|    |----------------------------
          |  |  |  |  |  |  |         |  |  |  |  |  |  |
          |  |  |  |  |  |  |         |  |  |  |  |  |  |
          |  v  v  v  v  v  v         v  v  v  v  v  v  v
          |
          |  <<---------   24 payments(-) --------->>
          v
        initial
        deposit
```
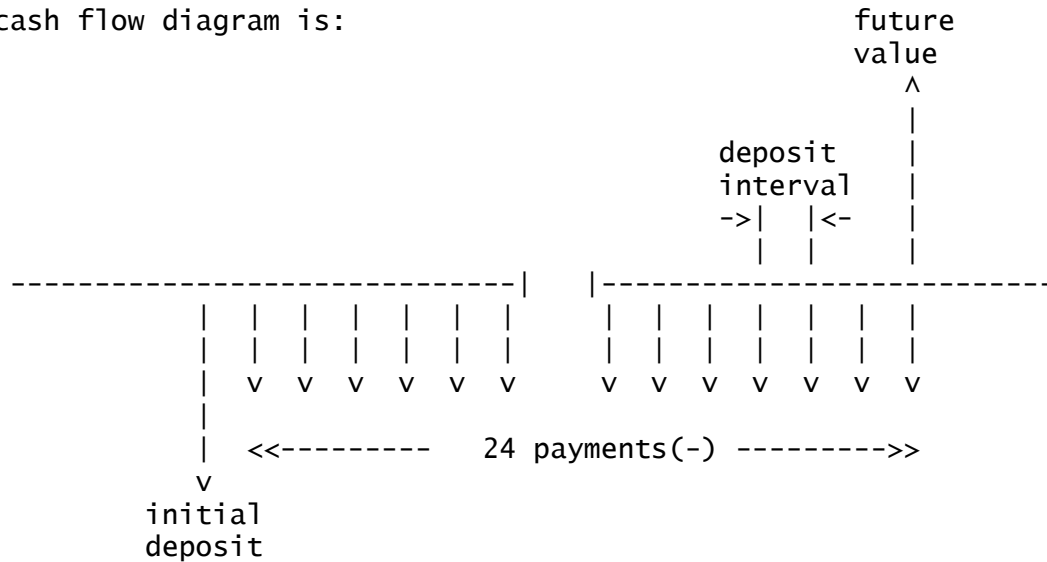
To answer the first question, set up the screen as shown below
and press [FV] to solve for the future value of the account after
24 months. The answer is $1395.33.

                    No. of payments: 24
                    Annual int. : 6.750 %
                    Pr. value: -100.00
                    Payment: -50.00
                    Fu. value: 0.00
                    No. of pmts/yr: 12
                    Payment mode: >End

                    [N] [I%YR] [PV] [PMT] [FV] [OTHER]

To answer the second question, enter 2000 in Fu. value and press
[N] to solve for the number of months required to save to a $2000
future value. The answer is 34 months.

                    No. of payments: 34
                    Annual int. : 6.750 %
                    Pr. value: -100.00
                    Payment: -50.00
                    Fu. value: 2000.00
                    No. of pmts/yr: 12
                    Payment mode: >End

                    [N] [I%YR] [PV] [PMT] [FV] [OTHER]

EXAMPLE #2 - A HOME LOAN

You want to borrow $75,000 to buy a house. The bank will loan
you the money for 25 years at 9.25%. What will be your monthly
payments to fully amortize the loan?

The cash flow diagram is:

```
              loan (+)
                 ^                            1
                 |                            month
                 |                            payment
                 |                            interval
                 |                            ->|  |<-
                 |                              |  |
    ----------------------------|  |----------------------
              | | | | | |         | | | | | | |
              | | | | | |         | | | | | | |
              v v v v v v         v v v v v v v

              <<--------  300 payments(-) --------->>
```

Set up the screen as shown below and press [PMT] to compute the
monthly payment amount. The answer is -$642.29.

                No. of payments: 300
                Annual int. : 9.250 %
                Pr. value: 75000.00
                Payment: 0.00
                Fu. value: 0.00
                No. of pmts/yr: 12
                Payment mode: >End

                [N] [I%YR] [PV] [PMT] [FV] [OTHER]

You can only afford $600/month. How much can you afford to
borrow from this bank?

Set up the screen as shown below and press [PV] to compute
the loan amount. The answer is $70,062.20.

                No. of payments: 300
                Annual int. : 9.250 %
                Pr. value: 75000.00
                Payment: -600.00
                Fu. value: 0.00
                No. of pmts/yr: 12
                Payment mode: >End

                [N] [I%YR] [PV] [PMT] [FV] [OTHER]

EXAMPLE #3 - A HOME LOAN WITH A BALLOON PAYMENT

Using the data from Example #2, you still need the $75,000.
You propose to the bank that you pay off the loan at the rate of
$600/month and then pay off any unpaid balance with a balloon
payment at the end of the 25 years. How much will that balloon
payment be?

The cash flow diagram is:

                                Time Value of Money 3-3
```

```
                 loan (+)
                    ^                        1
                    |                        month
                    |                        payment
                    |                        interval
                    |                        ->|  |<-
                    |                          |  |
     ---------------------------------|  |----------------------
              |  |  |  |  |  |         |  |  |  |  |  |  |
              |  |  |  |  |  |         |  |  |  |  |  |  |
              v  v  v  v  v  v         v  v  v  v  v  v  |
                                                         |
              <<---------   300 payments(-) -------->>|
                                                         |
                                            balloon   v
                                            payment
```

Set up the screen as shown below and press [FV] to compute the
value of the balloon payment. The answer is -$49,429.71.

```
                    No. of payments: 300
                    Annual int. :  9.250 %
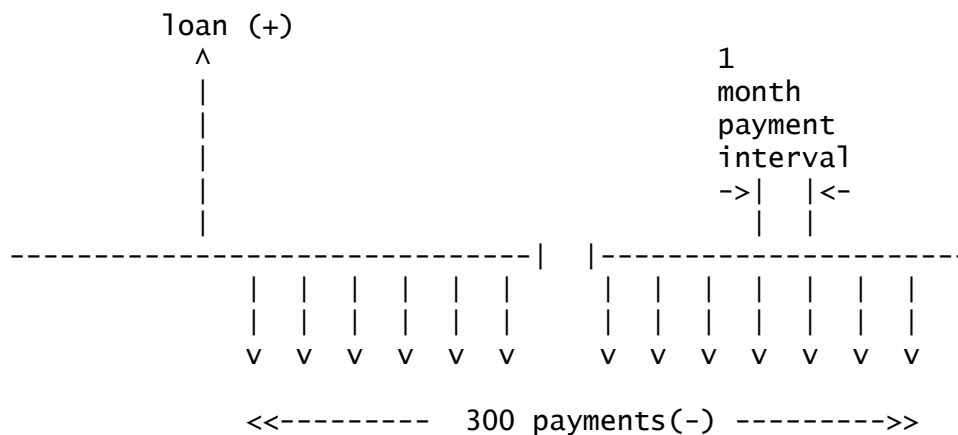                    Pr. value:  75000.00
                    Payment:       -600.00
                    Fu. value:        0.00
                    No. of pmts/yr:   12
                    Payment mode:    >End

                    [N] [I%YR] [PV] [PMT] [FV] [OTHER]
```

EXAMPLE #4 - A SINKING FUND

Your company traditionally pays $50,000 in dividends to its
shareholders annually. To meet this cash requirement, the board
of directors wants to set aside cash on a quarterly basis in an
interest bearing account. You can set up a sinking fund at 9.5%
interest. How much cash will you have to set aside in the fund
each quarter to meet this annual cash requirement.

The cash flow diagram is:
```
                                         ^
                                 future  |
                                 value   |
                                         |
          ---------------------------------
             |      |      |      |
             |      |      |      |
             v      v      v      v


             <<--- payments -->>
```

Set up the screen as shown below and press [PMT] to compute the
quarterly payment. Notice that, unlike the other examples, the

first periodic payment occurs at the beginning of the first period. Thus the payment mode should be set to "Begin". The answer is -$11,783.54.

```
                    No. of payments: 4
                    Annual int. : 9.500 %
                    Pr. value:      0.00
                    Payment:        0.00
                    Fu. value: 50000.00
                    No. of pmts/yr:   4
                    Payment mode: >Begin

          [N] [I%YR] [PV] [PMT] [FV] [OTHER]
```

AMORTIZATION

The TVM capabilities of the Financial Functions Library include the capability of computing the amortization data for any time period during an installment loan. You may also use the HP-82240B Infrared Printer to generate an amortization table. As an example, assume that, for the loan described in Example #2 above, you borrow the money on September 30, 1991 and that the first payment is due on October 31. What is the amortization data for the year 1993? Also, print out an amortization table for the years 1992 through 1999.

To begin the amortization calculation process, you should key in the cash flow information into the Time Value of Money Screen as shown in Example #2. Then press [PMT] to compute the payment. The answer as above is -$642.29. The screen at this time will look like:

```
                    No. of payments: 300
                    Annual int. : 9.250 %
                    Pr. value: 75000.00
                    Payment:     -642.29
                    Fu. value:      0.00
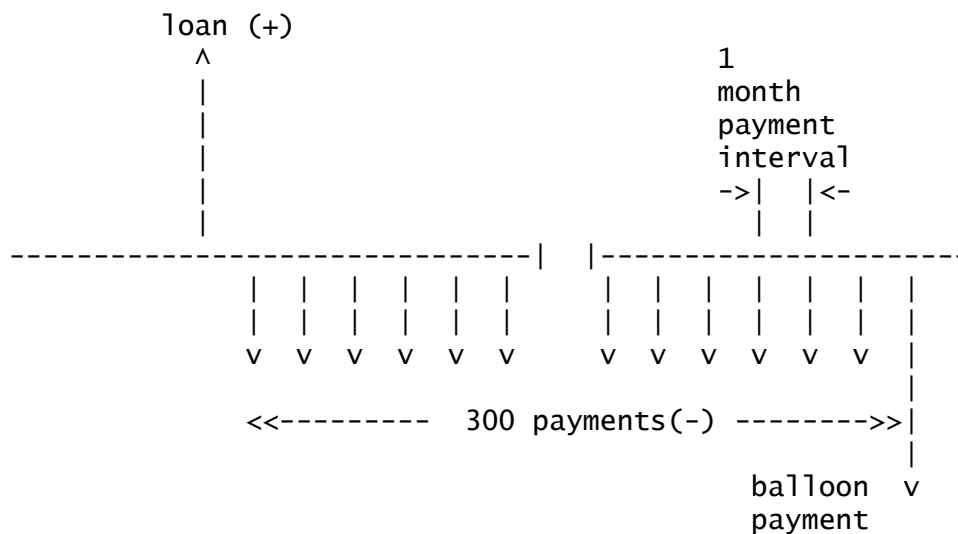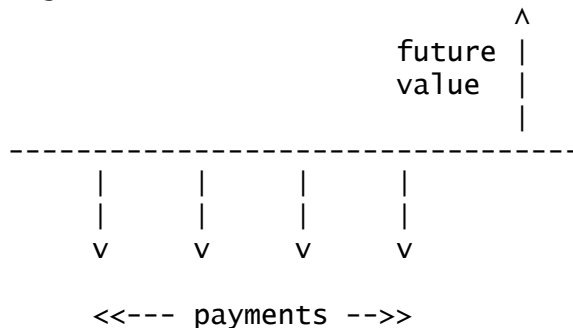                    No. of pmts/yr:  12
                    Payment mode:  >End

          [N] [I%YR] [PV] [PMT] [FV] [OTHER]
```

Now, press [OTHER] to see the alternative set of softkeys, and press [AMRT]. The Amortization Screen is shown as:

```
                     Amortization
                    No. of payments:  12
                    Interest:        0.00
                    Principal:       0.00
                    Balance:     75000.00
                    Start payment No.: 0
                    End payment No.  : 0

          [SOLVE][NEXT][TABLE][CLEAR][EXIT]
```

To determine the amortization data for 1993, it is necessary to
start with the status of the loan at the end of 1992. There will
be three payments made in 1991 and another twelve in 1992.   The
status of the loan at the end of 1992 will be at the end of 15
payments. Key 15 into the Payments line and press [SOLVE].
The resultant screen shown below will display the amortization
data for the first 15 payments.

```
            Amortization
            No. of payments:  15
            Interest:   -8618.17
            Principal:  -1016.13
            Balance:    73983.87
            Start payment No.: 1
            End payment No.  :15

            [SOLVE][NEXT][TABLE][CLEAR][EXIT]
```

Now, to determine the amortization data for 1993, key 12 into
the Payments line and press [NEXT] to solve for the amortization
data for the next 12 payments. The results are shown in the
screen below:

```
            Amortization
            No. of payments:  12
            Interest:   -6805.92
            Principal:   -901.51
            Balance:    73082.36
            Start payment No.:16
            End payment No.  :27

            [SOLVE][NEXT][TABLE][CLEAR][EXIT]
```

As you can see, during 1993 you will pay $6805.92 in interest
and $901.51 toward reducing the principal of the loan.

Now, to print the amortization table for the years 1992 through
1999, you need to press [TABLE].   You will now see   the
Amortization Table Screen. Fill it out as shown below:

```
            Amoetization Table
            First pmt No.:     4
            Last pmt No. :    99
            Increment:        12

            [PRINT]            [EXIT]
```

Now, be sure that your HP-82240B Infrared Printer is positioned
properly and turned ON. Press [PRINT]. The resultant
amortization table will appear as:

```
+---------------------+
|Interest(%/yr)=  9.25 |
|PR Value = 75000.00   |
|Payment= -642.29      |
|No. of pmts/yr= 12.00 |
|End mode              |
|                      |    +---------------------+
|Payments: 4 - 15      |    |Payments: 52 - 63    |
|Interest= -6885.28    |    |Interest=  -6518.86  |
|Principal= -822.16    |    |Principal= -1188.57  |
|Balance= 73983.87     |    |Balance=   69821.31  |
|                      |    |                     |
|Payments: 16 - 27     |    |Payments: 64 - 75    |
|Interest= -6805.92    |    |Interest=  -6404.14  |
|Principal= -901.51    |    |Principal= -1303.30  |
|Balance= 73082.36     |    |Balance=   68518.01  |
|                      |    |                     |
|Payments: 28 - 39     |    |Payments: 76 - 87    |
|Interest= -6718.91    |    |Interest=  -6278.34  |
|Principal= -988.53    |    |Principal= -1429.10  |
|Balance= 72093.83     |    |Balance=   67088.90  |
|                      |    |                     |
|Payments: 40 - 51     |    |Payments: 88 - 99    |
|Interest= -6623.49    |    |Interest=  -6140.39  |
|Principal= -1083.95   |    |Principal= -1567.04  |
|Balance= 71009.88     |    |Balance=   65521.86  |
                            +---------------------+
```

TIME VALUE OF MONEY SCREENS - REFERENCE

TIME VALUE OF MONEY SCREEN

Purpose of screen - to allow you to solve the five variable time
value of money problems.

Path - From the Main Menu, press [G]

```
              No. of payments:  0
              Annual int. : 0.000 %
              Pr. value:     0.00
              Payment:       0.00
              Fu. value:     0.00
              No. of pmts/yr:  12
              Payment mode:  >End

              [N] [I%YR] [PV] [PMT] [FV] [OTHER]
```

@@
No. of payments: is the number of equal payments.

Annual interest.: is the interest rate expressed as an annual
percentage. This screen assumes that the interest is compounded

with the same frequency as the payments are made.

Pr. value: is the value of the cash flow at the beginning of the
first period.

Payment: is value of the equal payments.

Fu. value: is the value of the cash flow at the end of the last
period.

No. of pmts / yr: is the number of payments made per year or
per the period for which the interest rate is stated.

Payment mode: indicates whether the periodic payments are
made at the beginning or at the end of each period.

@@

[N] will solve for the number of payments, given the other data
in the screen.

[I%/YR] will solve for the annual interest rate, given the other
data in the screen.

[PV] will solve for the value of the present value, given the
other data in the screen.

[PMT] will solve for the value of the periodic payments, given
the other data in the screen.

[FV] will solve for the future value, given the other data in the
screen.

[OTHER] will transfer to the alternate set of softkeys.

[AMRT] will transfer to the Amortization Screen (see below).

[OTHER] will return to the original set of softkeys.

[EXIT] will return to the previous screen or menu.

@@

AMORTIZATION SCREEN

Purpose of screen - to allow you to solve for the amortization
data for an installment loan.

Path - From the Main Menu, press [G], [OTHER], [AMRT].

```
              Amortization
         No. of payments:    0
         Interest:       0.00
         Principal:      0.00
         Balance:        0.00
         Start payment No.: 0
         End payment No.  : 0

         [SOLVE][NEXT][TABLE][CLEAR][EXIT]
```

@@

No. of payments: is the number of payments for which you
wish to compute the amortization data. All other data for this
screen are based on the values currently in the Time Value of
Money Screen.

Interest {output only}: is the total interest paid during the
amortization period.

Principal {output only}: is the total payments applied to the
principal of the load during the amortization period.

Balance{output only}: is the value of the remaining balance of
the loan at the end of the amortization period.

Start payment No. {output only}: is the number of the first
payment during the amortization period.

End payment No. {output only}: is the number of the last
payment during the amortization period.

@@

[SOLVE] will solve for the amortization data from the first
payment to the one shown in the No. of payments line.

[NEXT] will solve for the amortization data for the number of
periods shown in the No. of payments line, beginning with the
next one after the current End Payment Number.

[TABLE] will transfer to the Amortization Table Screen (see
below).

[CLEAR] will clear the Amortization Screen.

[EXIT] will return to the previous screen or menu.

@@

```
--------------------------
AMORTIZATION TABLE SCREEN
--------------------------


Purpose of screen - to allow you to print an Amortization Table
on your HP-82240B Infrared Printer.

Path - From the Main Menu, press [G] [OTHER] [AMRT] [TABLE]

                     Amoetization Table
                 First pmt No.:   0
                 Last pmt No. :   0
                 Increment:       0

                 [PRINT]              [EXIT]
```

@@

First payment No.: is the number of the first payment to be
printed in the table.

Last payment No.: is the number of the last payment to be
printed in the table.

Increment: is the number of payments to be "bundled" into each
element in the amortization table. For example, to bundle an
entire year into each computation, the increment should be 12.

@@

[PRINT] will begin the actual printout.

[EXIT] will return to the previous screen or menu.

@@

4. MARKUP

===

In this chapter, you will study the
screens associated with the Markup
capabilities of the Financial Functions
Library.

MARKUPS AND DISCOUNTS

The four screens in the Markup Menu can be used to compute
markups or discounts based either on price or on cost. Two of
these screens will also allow you to compute percentages and
percents of change. In each of these screens, there are three
variables. The process of solving a problem is similar in each
case. Use the cursor keys to move around the screen to highlight
the fields of data that you know. Then key in the known data.
When you have all of the known data keyed into the screen, press
the softkey associated with the unknown value, and that value
will be computed and loaded into the screen in the proper field.

EXAMPLE #1 - MARKUP BASED ON COST

The problem: You own a business where you typically markup your
goods by 18% for resale. An item costs you $24.95. For how much
should you price it?

From the Main Menu, press [H] for the Markup Menu. Then press
[G] for the Markup on Cost Screen. Fill out the screen as shown
below and press [PRICE]. The solution is: $29.44.

```
            Markup On Cost
        Cost:        24.95
        Price:        0.00
        MU on cost: 18.000 %

        [MU%C][COST][PRICE]    [EXIT]
```

EXAMPLE #2 - DISCOUNT BASED ON PRICE

The problem: You are a manufacturing company that provides its
dealers products at a 30% discount from manufacturer's suggested
list price. You have a new product that, based on your costs,
you need to generate $275.00 in revenue. Given you discount
policy, how should you price this product?

From the Main Menu, press [H] for the Markup Menu. Then,
press [H] for the Markup on Pice Screen. Fill out the screen as
shown below and press [PRICE]. The solution is: $392.86.

```
                Markup On Price
        Cost:          275.00
        Price:           0.00
        MU on price: 30.000 %

        [MU%P][COST][PRICE]    [EXIT]
```

EXAMPLE #3 - PERCENT CHANGE

The problem: You have bought some common stock for $25.25/share.
You would like to sell it if it increases in value by at least
20%.   At what price should you place your sell order with your
broker?

From the Main Menu, press [H] for the Markup Menu. Then, press
[I] for the Percent Change Screen. Fill out the screen as shown
below and press [NEW]. The solution is: $30.30 or $30 3/8.

```
                Percent Change
        Old: 25.25
        New: 0.00
        % change: 20.000 %

        [%CHG][OLD][NEW]    [EXIT]
```

EXAMPLE #4 - PERCENT OF TOTAL

The problem: You company makes three products that generated the
following revenue amounts for the 2nd quarter:

 Product 1 $38,514
 Product 2 $47,427
 Product 3 $11,250

To what percentage of total revenue does each product contribute?

From the Main Menu, press [H] for the Markup Menu. Then, press
[J] for the Percent of Total Screen. Move the cursor to the
Total line and press [left-shift] [A].   This will transfer
control to the 48's operating system so that you can add up the
three revenues and compute the total. Key in each value into the
stack and press [+] in turn. The total is $97,191.00. Now press
[left-shift][CONT].   The system will return to the Percent of
Total Screen, and the total amount will be loaded into the Total
line. Fill out the Part line with the first product's revenue as
shown in the screen below and press [%TOTL]. The solution is
39.627%.

```
                Percent of Total
        Total:     97191.00
        Part:      38514.00
        % of total:  0.000 %
```

```
            [%TOTL][TOTAL][PART]   [EXIT]
In like manner, you may compute the percents of the other two
products:

 Product 1 $38,514 39.627%
 Product 2 $47,427 48.798%
 Product 3 $11,250 11.575%
```

MARKUP SCREENS - REFERENCE

MARKUP ON COST SCREEN

Purpose of screen - to allow you to solve for markups or
discounts based on cost.

Path - From the Main Menu, press [H] [G]

```
              Markup On Cost
          Cost:         0.00
          Price:        0.00
          MU on cost:  0.000 %

          [MU%C][COST][PRICE]    [EXIT]
```

@@@

Cost: is the amount of the cost of an item.

Price: is the amount of the price of an item.

MU on price: is the markup (or discount) computed based on the
value of the cost. The calculation is the price less the cost
divided by the cost.

@@@

[MU%C] will solve for the markup (or discount), given the
other data in the screen.

[COST] will solve for the value of cost, given the other data in
the screen.

[PRICE] will solve for the value of price, given the other data
in the screen.

[EXIT] will return to the previous screen or menu.

@@@

```
----------------------
MARKUP ON PRICE SCREEN
----------------------
Purpose of screen - to allow you to solve for markups or
discounts based on price.

Path - From the Main Menu, press [H] [H]

                    Markup On Price
                Cost:          0.00
                Price:         0.00
                MU on price: 0.000 %

                [MU%P][COST][PRICE]    [EXIT]

@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

Cost: is the amount of the cost of an item.

Price: is the amount of the price of an item.

MU on cost: is the markup (or discount) computed based on the
value of the cost.  The calculation is the price less the cost
divided by the price.
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

[MU%C] will solve for the markup (or discount), given the
other data in the screen.

[COST] will solve for the value of cost, given the other data in
the screen.

[PRICE] will solve for the value of price, given the other data
in the screen.

[EXIT] will return to the previous screen or menu.
@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@

---------------------
PERCENT CHANGE SCREEN
---------------------
Purpose of screen - to allow you to solve for the percent of
change between two values of a quantity.

Path - From the Main Menu, press [H] [I]

                    Percent Change
                Old: 0.00
                New: 0.00
                % change: 0.000  %

                [%CHG][OLD][NEW]    [EXIT]
```

@@

Old: is the "old" or first value of the quantity.

New: is the "new" or second value of the quantity.

% change: is the percent of change from the old value to the new
value based on the old value. The calculation is the new value
less the old value divided by the old value.

@@

[%CHG] will solve for the percent of change, given the other
data in the screen.

[OLD] will solve for the old value, given the other data in the
screen.

[NEW] will solve for the new value, given the other data in the
screen.

[EXIT] will return to the previous screen or menu.
@@

PERCENT OF TOTAL SCREEN

Purpose of screen - to allow you to compute the percentage of a
total that a partial amount is.

Path - From the Main Menu, press [H] [J]

                    Percent of Total
              Total: 0.00
              Part: 0.00
              % of total: 0.000 %

              [%TOTL][TOTAL][PART]   [EXIT]

@@

Total: is the total amount.

Part: is the part of the total amount.

% of total: is the percent of the total represented by the part.
The calculation is the part divided by the total expressed as a
percent.
@@

[%TOTL] will solve for the percent of total, given the other
data in the screen.

[TOTAL] will solve for the total value, given the other data in the screen.

[PART] will solve for the part value, given the other data in the screen.

[EXIT] will return to the previous screen or menu.

@@

5. CASH FLOW ANALYSIS

===

In this chapter, you will study the
screens associated with the Cash
Flow Analysis capabilities of the
Financial Functions Library.

CASH FLOW ANALYSIS

Cash flow analysis deals with a class of financial situations
where periodic financial transactions (cash flows) take place and
the money is earning compound interest during the time periods
described by the problem. In this regard, generalized cash flow
analysis is like the Time Value of Money problems described in
Chapter 3 of this manual. However, while the TVM screens
required all of the periodic cash flows (PMTs) to be equal, the
Cash Flow Analysis screens are ideally suited for situations
where the cash flow amounts may vary from one period to the next.

The remaining two constraints of the TVM Screens still apply:
namely, that the periods must be equal and that the payment
periods must correspond to the compounding periods.

==> NOTE: Problems for which the periodic payment
     amounts are the same may be solved in the Time Value
     of Money Screen.

THE GENERAL APPROACH TO THE PROBLEM

Since the cash flows may be unequal and in any amount, the first
step in the process of doing a cash flow analysis is to list the
cash flows in a way that the Financial Functions Library can deal
with them. This is called a Cash Flow List, and it is described
in detail in the next section.

Once the list is created, there are several computations that the
Financial Functions Library Screen can do for you. By pressing
the [SOLVE] key, you can compute the Total of the cash flows, and
the Net Present Value (NPV), the Net Uniform Series (NUS), and
the Net Future Value (NFV) of the cash flow list. Also by
pressing [IRR%], you can compute the Internal Rate of Return
(IRR) of the cash flow list.

THE CASH FLOW LIST

Unequal cash flows can occur in either of two ways, random or
grouped. As the name implies, random cash flows are truly random
and can occur in any amount for any period. On the other hand,
grouped cash flows have the characteristic that the same cash
flow amount occurs repeatedly for a certain number of periods

before the amount changes. These two situations are illustrated
by the cash flow diagrams shown below:

Random cash flows:

```
                        cash flows
                                              ^           ^
                  ^                           |           |
          ^       |                     ^     |  ^        |
      ^   |   ^   |   ^                 |     |  |  ^     |
      |   |   |   |   |   ^             |     |  |  |  ^  |
      |   |   |   |   |   |             |     |  |  |  |  |
  ------------------------------      --------------------
  |                   |   |   |
  |                   |   v   |
  |                   v       v
  |
  v
    initial investment
```

Grouped cash flows:

```
                     cash flow groups
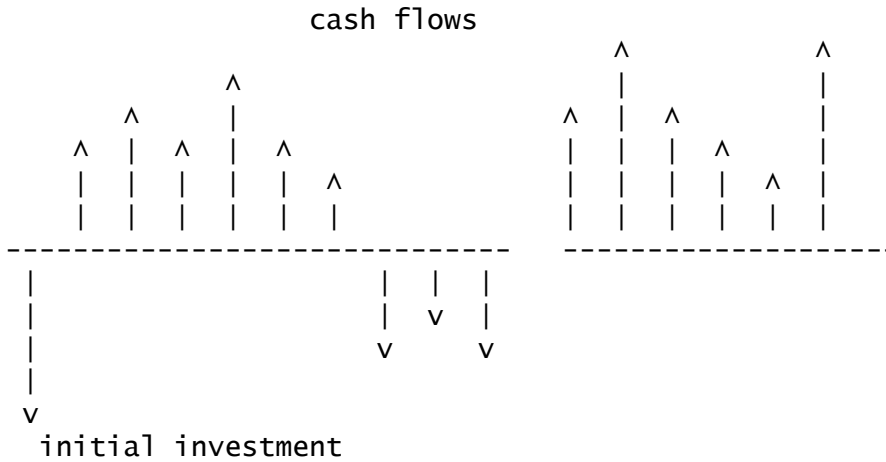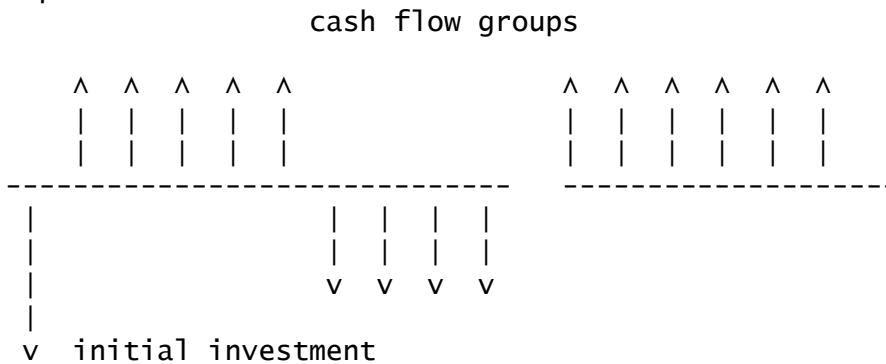
      ^  ^  ^  ^  ^                    ^  ^  ^  ^  ^  ^
      |  |  |  |  |                    |  |  |  |  |  |
      |  |  |  |  |                    |  |  |  |  |  |
  ------------------------------      --------------------
  |                 |  |  |  |
  |                 |  |  |  |
  |                 v  v  v  v
  |
  v  initial investment
```

In the Financial Functions Library, the cash flow list may be
random, grouped or a combination of the two.

EXAMPLE #1

Generate a cash flow list for an investment that requires an initial
payment of $10,000 and promises annual returns as illustrated on
the cash flow diagram below. Store this cash flow list under the
name "FLOW1"

```
                                        $5000
                              $4000      ^
                    $3000      ^         |
          $2000      ^         |         |
            ^        |         |         |
            |        |         |         |
  ------------------------------------------
  |                      ->| 1 year|<-
  |
  |
  |
  v   -$10000
```

From the main menu, press [I]. You will see the Cash Flow Screen
as shown below:

                    Cash Flow
             Interest rate: 0.000 %
             Total: 0.00
             NPV :   0.00
             NUS :   0.00
             NFV :   0.00
             IRR% :   0.000

             [SOLVE][IRR%] [LIST] [EXIT]

Now press [LIST]. You will see Cash Flow List Menu:

                  Cash Flow List Menu
             [G] Edit C.F. list
             [H] Clear C.F. list
             [I] Store C.F list
             [J] Recall C.F. list
             [K] Delete C.F. list
                                [EXIT]

To create the list as required, press [G]. You will see the Cash
Flow List Screen:
                +------------------------+
                | |
                | |
                | |
                | |
                |NXT FLO? |
                +------------------------+
                [TOP] [END] [PRINT] [DEL]   [EXIT]

To enter the cash flow list, key in each element in the list in
turn and then press [ENTER]. You can scroll to any element of
the list by using the vertical cursor keys. The [TOP] key will
take you to the top of the list. The [END] key will take you to
the bottom of the list. The [DEL] key will delete the last
element in the list that is visible in the screen. Keying in a
new element will insert that element in the list after the last
element that is visible in the screen.

When properly filled out, the list will look like:

                +------------------------+
                |-10000 |
                |2000 |
                |3000 |
                |4000 |
                |5000 |
                |NXT FLO? |
                +------------------------+
                [TOP] [END] [PRINT] [DEL]   [EXIT]

To save this list for later use under the name "FLOW1", press
[EXIT] to get to the Cash Flow List Menu. Then press [I].
You will be prompted for the name under which you want to store
the list. Type in FLOW1 and press [ENTER].

==> NOTE: When you are being prompted for a name, the
     software will set alpha mode automatically. It is not
      necessary for you to press the [a] key.

EXAMPLE #2

An alternative investment requires the same initial $10,000, but
makes returns on a monthly basis as shown in the cash flow
diagram below. Generate a cash flow list for this investment and
store it under the name "FLOW2"

```
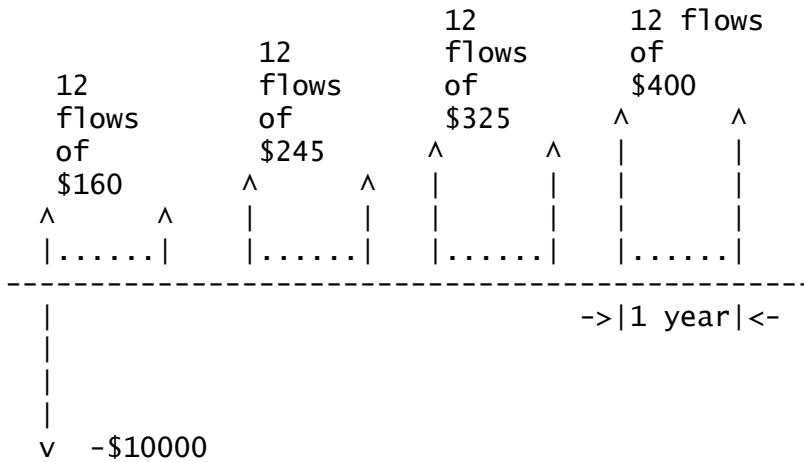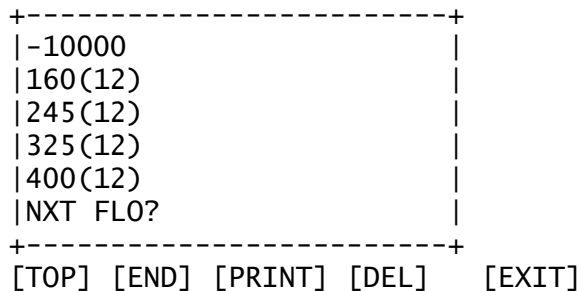                                 12          12 flows
                      12         flows       of
          12          flows      of          $400
          flows       of         $325        ^          ^
          of          $245       ^       ^   |          |
          $160        ^       ^  |       |   |          |
          ^       ^   |       |  |       |   |          |
          |......|    |......|   |......|    |......|
      ----------------------------------------------
          |                              ->|1 year|<-
          |
          |
          |
          v   -$10000
```

This is an example of grouped cash flows. First, return to the
Cash Flow List Menu and press [H] to clear the existing payment
list. (Respond [Y] to the prompt). You have stored it under the
name "FLOW1" so that you will be able to recall it later.   Now,
press [G] to enter the new list. The first element will be -
10000 as before. Press [ENTER]. Next key in 160 to represent
the next cash flow amount. However, since this is an amount that
is repeated 12 times (monthly), you can indicate this by adding
the number 12 in parentheses after the cash flow amount.   The
parenthesis symbol is the gold shifted function above the [()]
key. However, it is not necessary to press the shift key to key
in the parenthesis symbol. Press: [1] [6] [0] [()] [1] [2] [()]
[ENTER]. Repeat this process for the remaining grouped cash
flows. When properly filled out, your list should look like:

```
            +------------------------+
            |-10000                  |
            |160(12)                 |
            |245(12)                 |
            |325(12)                 |
            |400(12)                 |
            |NXT FLO?                |
            +------------------------+
            [TOP] [END] [PRINT] [DEL]    [EXIT]
```

Now store this under the name "FLOW2" as before. From the Cash
Flow List Menu press [I]; key in the name FLOW2; and, press
[ENTER].

CASH FLOW ANALYIS OF THE TWO EXAMPLES

The objective now is to perform a cash flow analysis of the two
investments in order to determine which one is preferable. To
begin, press [J] from the Cash Flow List Menu to see a listing of
the names of all of the cash flow lists that you have created.
Using the vertical cursor keys, move the scroll bar to the list
"FLOW1" and press [SELCT]. Press [EXIT] to return to the Cash
Flow Screen. Now, with this list active, there are two
calculations that you may do. You may specify an assumed annual
interest rate and compute the Total of cash flows, the Net
Present Value (NPV), the Net Uniform Series (NUS), and the Net
Future Value(NFV) of this cash flow. Assume an interest rate of
9% and do this. Key in 9 into the top line of the display and
press [SOLVE]. The Financial Functions Library will compute
these four values and return them to the proper lines of the
display. You may also press [IRR%]. The Financial Functions
Library will compute the Internal Rate of Return (IRR) for this
investment and return the answer to its line in the display.
This value does not depend on the value of the assumed interest
rate. When you have performed both of these tasks, the Cash Flow
Screen should look like:


```
              Cash Flow
        Interest rate: 9.000 %
        Total:       4000.00
        NPV  :        990.76
        NUS  :        305.82
        NFV  :       1398.54
        IRR% :         12.826

        [SOLVE][IRR%]  [LIST]  [EXIT]
```

Next, you can return to the Cash Flow List Menu and recall the
list "FLOW2" to active status. Return to the Cash Flow Screen
and repeat the calculations used above. However, you must be
careful in selecting the assumed interest rate. The assumed
interest rate in the previous example was 9.00%. This was an
annual amount because the cash flows were on an annual basis.
The interest rates required in the Cash Flow Screen are periodic
rates, not necessarily annual rates. Since the cash flows occur
on a monthly basis, the assumed rate for this screen should be
0.75% (9/12%), . Key in .75 into the top line and press [SOLVE].
Then press [IRR%]. When all of this has been done properly, the
resultant screen will look like:

```
                Cash Flow
        Interest rate: 0.750 %
        Total:       3560.00
        NPV  :        992.30
        NUS  :         24.69
        NFV  :       1420.39
        IRR% :         1.102

          [SOLVE][IRR%]  [LIST]  [EXIT]
```

Again, the value of IRR is based on a periodic (monthly) rate. To get the annual rate, multiply by 12. This gives 13.224%. It is clear from this analysis that, even though the first investment results in a greater cash flow total, the second investment generates a higher yield.

CASH FLOW ANALYSIS SCREENS – REFERENCE

CASH FLOW SCREEN

Purpose of screen – to allow you to perform cash flow analysis on previously generated cash flow lists.

Path – From the Main Menu, press [I].

```
                Cash Flow
        Interest rate: 0.000 %
        Total:          0.00
        NPV  :          0.00
        NUS  :          0.00
        NFV  :          0.00
        IRR% :          0.000

          [SOLVE][IRR%]  [LIST]  [EXIT]
```

@@@
Interest rate: is the assumed periodic interest rate used in calculations for NPV, NUS, and NFV.

Total {output only}: is the computed total of the cash flows in the currently active cash flow list.

NPV {output only}: is the computed Net Present Value of the cash flows in the currently active cash flow list.

NUS {output only}: is the computed Net Uniform Series of the cash flows in the currently active cash flow list.

NFV {output only}: is the computed Net Future Value of the cash flows in the currently active cash flow list.

IRR% {output only}: is the computed Internal Rate of Return
for the cash flows in the currently active cash flow list.   This
rate is express as the periodic rate with the period equal to the
cash flow period.

@@

[SOLVE] will solve for the Total, NPV, NUS, and NFV for
the currently active cash flow list with the assumed periodic
interest rate given in the screen.

[IRR%] will solve for the IRR for the currently active cash
flow list.

[LIST] will transfer to the Cash Flow List Menu (see below).

[EXIT] will return to the previous screen or menu.
@@

CASH FLOW LIST MENU

Purpose of menu - to allow you to generate, edit, store and recall
cash flow lists for analysis by the Cash Flow Screen (see above).

Path - From the Main Menu, press [I] [LIST].

                    Cash Flow List Menu
            [G] Edit C.F. list
            [H] Clear C.F. list
            [I] Store C.F list
            [J] Recall C.F. list
            [K] Delete C.F. list
                                [EXIT]

@@

[G] will transfer to the Cash Flow List Screen with the currently
active list displayed (see below).

[H] will clear the currently active list. You will first be
prompted to be sure.

[I] will prompt you for a name under which to store the
currently active list. Key in the name and press [ENTER]. If
you key in a name already used, you will be prompted whether
or not you want to overwrite.

[J] will display the list of cash flow names currently stored in
memory. Move the scroll bare to the one you want to recall and
press [SELCT].

[K] will display the list of cash flow names currently stored in
memory. Move the scroll bar to the one you want to delete and
press [SELCT]. You will be prompted to see if you are sure.

[EXIT] will return to the previous screen or menu.]

@@

CASH FLOW LIST SCREEN

Purpose of screen - to allow you to generate and edit a cash flow
list.

Path - From the Main Menu, press [I].[LIST] [G]

```
                    +------------------------+
                    |                        |
                    |                        |
                    |                        |
                    |                        |
                    |                        |
                    |                        |
                    |NXT FLO?                |
                    +------------------------+
                    [TOP] [END] [PRINT] [DEL]    [EXIT]
```

@@

Each line in the screen represents a single cash flow or a group
of equal valued cash flows. To enter a single cash flow, key in
the amount and press [ENTER]. The cash flow will be inserted in
the list where shown. To enter a group of cash flows, key in the
amount and then [()];. the number of flows in the group; and,
[()] again. The   key will place parentheses around the number
of flows.

@@

[TOP] will move to the top of the list displaying the first flow.

[END] will move to the end of the list displaying the last flow.

[PRINT] will print the cash flow list to the infrared printer.

[DEL] will delete the entry in the last visible line in the
display.

[EXIT] will return to the previous screen or menu.

@@

6. INTEREST RATE CONVERSIONS
==

In this chapter, you will study the
screens associated with the Interest
Rate Conversion capabilities of the
Financial Functions Library.

INTEREST RATES - SOME BACKGROUND

When you invest money, you should be very interested in the
interest rate that investment provides. That interest, usually
expressed as a percent, is the amount that the money invested
will return to you over and above the principal amount invested
after some standard time period (usually one year). Thus, if you
invest $100 at an annual interest rate of 10%, you can expect to
receive $110 back at the end of one year. This example
represents a situation known as simple interest.

However, many investments do not require you to wait an entire
year before you receive some of your earnings. In the previous
example, after only one month, your investment should have earned
$0.83 (1/12 of $10). At that time, you may be presented with the
choice of collecting your $0.83 or having it added to the
principal, so that you would now have $100.83 earning interest.
Then, after the next month, you will have earned $0.84. This
process of periodically adding earnings to the principal is known
as compounding. In this example, the investment pays 10%
interest compounded monthly or 12 times/year.

Often it is desired to know what the effective interest rate is
for a given compounding situation. In fact, many banking
institutions are required, by law, to provide this information to
their depositors. Effective interest is the equivalent simple
interest that would result in the same earnings being generated
by the given deposit. It is always higher than the stated or
nominal interest.

There are well defined mathematical relationships between the
nominal and effective interest rates based on the rate and the
compounding frequency or number of compounding periods per year.
As you might imagine, the more compounding periods in a year, the
higher the effective interest rate. Compounding can even be
taken to its extreme limit, continuous compounding. The Financial
Functions Library provides the ability to do these conversions
quickly and easily.

EXAMPLE

The problem: What is the effective interest rate for a nominal
interest rate of 9.5% compounded quarterly?, monthly?,
continuously?

From the Main Menu, press [J] for the Interest Rate Conversion
Screen. Fill out the screen as shown below and press [EFF%].
The answer is given in the Effect. int. line. It is 9.844%.

                 Interest Rate Conv.
               Conv. method: >PERIOD
               Nominal int: 9.500 %
               Effect. int: 0.000 %
               Comp. periods/yr: 4

               [NOM%] [EFF%]   [EXIT]

For the second part, change the Compounding periods/yr to 12 as
shown and press [EFF%] again. The answer this time is 9.925%.

                 Interest Rate Conv.
               Conv. method: >PERIOD
               Nominal int: 9.500 %
               Effect. int: 0.000 %
               Comp. periods/yr: 12

               [NOM%] [EFF%]   [EXIT]

For   the third part, change the Conversion method from PERIOD
(periodic) to CONT (continuous). Move the scroll bar to the top
line and press either of the horizontal cursor keys, [<] or [>].
Now, press [EFF%] again. The answer, 9.966%, is shown in the
Effective Interest line.

                 Interest Rate Conv.
               Conv. method: >CONT
               Nominal int: 9.500 %
               Effect. int: 0.000 %
               Comp. periods/yr: 12

               [NOM%] [EFF%]   [EXIT]

INTEREST RATE CONVERSION SCREEN - REFERENCE

INTEREST RATE CONVERSION SCREEN

Purpose of screen - to allow you to solve interest rate
conversions from nominal to effective rate and vice-versa.

Path - From the Main Menu, press [J].

                  Interest Rate Conv.
            Conv. method: >PERIOD
            Nominal int: 0.000 %
            Effect. int: 0.000 %
            Comp. periods/yr: 12

            [NOM%] [EFF%]   [EXIT]

@@@

Conv. method: is the method of compounding, either periodic or
continuous.

Nominal int.: is the nominal (or stated) annual interest rate.

Effec. int.: is the effective annual interest rate.

Comp. periods/yr: is the number of compounding periods per
year. This value is ignored if the method is continuous.

@@@

[NOM%] will solve for the nominal annual interest rate, given
the other data in the screen.

[EFF%] will solve for the effective annual interest rate, given
the other data in the screen.

[EXIT] will return to the previous screen or menu.

@@@

```
                       7. DEPRECIATION
      ====================================================
```

                    In this chapter, you will study the
                    screens associated with the Depreciation
                    capabilities of the Financial Functions
                    Library.

DEPRECIATION BASICS

The depreciation capabilities of the Financial Functions Library
allow you to compute the value for the depreciation of an asset
for any year of a scheduled depreciation over several years.   The
Library   supports   three   different   methods   of   computing
depreciation. They are:

        Straight Line
       Declining Balance
       Sum-of-the-Years' Digits

These methods require that the cost basis, the salvage value and
the expected life be known. In addition, the Declining Balance
method requires that the declining balance factor, expressed as a
percentage, also be known.

EXAMPLE

Your company has purchased a piece of equipment that cost
$125,000 and has a useful life of 10 years. The salvage value at
the end of its life will be $2000. What will be the depreciated
amount in the 4th year of ownership using each of the methods.
For the declining balance method, assume a declining balance
factor of 200% (double declining balance).

STRAIGHT LINE

From the Main Menu, press [K]. You will see the Depreciation
Screen. Fill it out as shown:

                  Cost Basis: 125000.00
                  Salvage: 2000.00
                  Life(yrs):   10
                  BD factor: 0.000 %
                  Year of deprc.:   4
                  Depreciation: 0.00
                  Remain V.:   0.00

                  [DB] [SL] [SOYD]   [EXIT]

Now press [SL]. The Financial Functions Library will compute the
depreciation for the fourth year and the remaining depreciatable
value after the fourth year. The solution screen then appears
as:

```
          Cost Basis:  125000.00
          Salvage:       2000.00
          Life(yrs):          10
          BD factor:      0.000 %
          Year of deprc.:      4
          Depreciation: 12300.00
          Remain V.:     73800.00

          [DB] [SL] [SOYD]    [EXIT]
```

The depreciation is $12,300, and the remaining depreciatable
value is $73,800.

DECLINING BALANCE

From the Main Menu, press [K], you will see the Depreciation
Screen. Fill it out as shown:

```
          Cost Basis:  125000.00
          Salvage:       2000.00
          Life(yrs):          10
          BD factor:    200.000 %
          Year of deprc.:      4
          Depreciation:    0.00
          Remain V.:       0.00

          [DB] [SL] [SOYD]    [EXIT]
```

Now press [DB]. The Financial Functions Library will compute the
depreciation for the fourth year and the remaining depreciatable
value after the fourth year. The solution screen appears as:

```
          Cost Basis:  125000.00
          Salvage:       2000.00
          Life(yrs):          10
          BD factor:    200.000 %
          Year of deprc.:      4
          Depreciation: 12800.00
          Remain V.:     49200.00

          [DB] [SL] [SOYD]    [EXIT]
```

The depreciation is $12,800, and the remaining depreciatable
value is $49,200.

SUM-OF-THE-YEARS' DIGITS

From the Main Menu, press [K]. You will see the Depreciation
Screen. Fill it out as shown:

```

```
                    Cost Basis: 125000.00
                    Salvage: 2000.00
                    Life(yrs):   10
                    BD factor: 0.000 %
                    Year of deprc.:   4
                    Depreciation: 0.00
                    Remain V.:   0.00

                    [DB] [SL] [SOYD]   [EXIT]
```

Now   press [SOYD]. The Financial Functions Library will compute
the   depreciation for the fourth year and the remaining
depreciatable value after the fourth year. The solution screen
then appears as:

```
                    Cost Basis:  125000.00
                    Salvage:       2000.00
                    Life(yrs):          10
                    BD factor:      0.000 %
                    Year of deprc.:      4
                    Depreciation: 15654.55
                    Remain V.:    46963.64

                    [DB] [SL] [SOYD]    [EXIT]
```

The depreciation is $15,654.55, and the remaining depreciatable
value is $46,963.64.

DEPRECIATION SCREEN - REFERENCE

DEPRECIATION SCREEN

Purpose of screen - to allow you to calculate depreciation
amounts for any given year for a depreciatable asset.

Path - From the Main Menu, press [K].

```
                    Cost Basis:   0.00
                    Salvage:      0.00
                    Life(yrs):       0
                    BD factor:   0.000 %
                    Year of deprc.:  0
                    Depreciation: 0.00
                    Remain V.:    0.00

                    [DB] [SL] [SOYD]    [EXIT]
```

@@@

Cost Basis: is the initial cost of the asset.

Salvage: is the value of the asset at the end of its life.

Life (yrs): is the assumed life (in years).

DB factor: is the acceleration factor for the declining balance method.

Year of deprc.: is the year for which the depreciation calculation is to be made.

Depreciation{output only}: is the computed depreciation for the given year.

Remain V. {output only}: is the remaining depreciatable value (not including salvage value) at the end of the given year.

@@

[DB] will solve for the depreciation and the remaining value using the declining balance method for the values given in the screen.

[SL] will solve for the depreciation and the remaining value using the straight line method for the values given in the screen. The straight line method ignores the DB factor.

[SOYD] will solve for the depreciation and the remaining value using the sum-of-the-years' digits method for the values given in the screen. The sum-of-the-years' digits method ignores the DB factor.

[EXIT] will return to the previous screen or menu.

@@

APPENDIX A

===

This Appendix provides the formulas used in the
TDS Financial Functions Library for your reference.

TIME VALUE of money FORMULAS

In Time Value of Money Calculations, there are four actuarial
functions which are used:

The Single Payment Present Value Function (SPPV)

$SPPV(i,n) = (1 + i)^{-n}$ [where i is the periodic interest
rate expressed as a fraction, and n is the number of compounding
periods].

The Single Payment Future Value Function (SPFV)

$SPFV(i,n) = (1 + i)^n$ [where i is the periodic interest
rate expressed as a fraction, and n is the number of compounding
periods].

The Uniform Series Present Value Function (USPV)

$USPV(i,n) = (1 - (1 + i)^{-n}) / i$ [where i is the periodic
interest rate expressed as a fraction, and n is the number of
compounding periods].

The Uniform Series Future Value Function (USFV)

$USFV(i,n) = ((1 + i)^n - 1) / i$ [where i is the periodic
interest rate expressed as a fraction, and n is the number of
compounding periods].

The Time Value of money equation is:

PV + (1 + i x) * PMT * USPV(i,n) + FV * SPPV(i,n) = 0
[where i is the periodic interest rate expressed as a fraction; n
is the number of compounding periods; PV is the present value;
FV is the future value; PMT is the periodic payment; and, x is
the payment mode factor (0 for END or 1 for BEGIN mode)].

This equation requires that four of the five variables are known.
It is then solved for the unknown value.

MARKUP FORMULAS

Markup based on cost:

MUc = (price - cost) / cost

Markup based on price:

```
        MUp = (price - cost) / price
```

Percent change

```
    %Change = (new - old) / old * 100
```

Percent of total

```
    %of total = part / total * 100
```


CASH FLOW FORMULAS

Net Present Value:

$$NPV = CF0 + \sum_{j=1}^{k} (CFj * USPV(i,nj) * SPPV(i,Nj))$$

[where CFj is the cash flow for the jth group; nj is the number of times that the cash flow appears in the jth group; and,

$$Nj = \sum_{m=1}^{j-1} nm]$$

$$NFV = NPV . SPFV(i,N) \quad [where \ N = \sum_{m=1}^{k} nm$$

and where k is the number of the last group.]

NUS = NPV/(USPV(i,N)).

To solve for IRR, set the NPV = 0 in the NPV formula and solve for i.

INTEREST RATE CONVERSION FORMULAS

For periodic compounding:

$eff = ((1 + nom / p)^p -1)$ [where eff is the effective rate; nom is the nominal rate (both expressed as a fraction); and, p is the number of compounding periods per year].

For continuous compounding:

$eff = e^{nom} -1$.

DEPRECIATION FORMULAS

Straight line:

SL = (Basis - Salv)/Life [where Basis is the basis, Salv is the

salvage value; and, Life is the life in years].

Declining Balance:

     DB = ((Basis * fact)*(1 - fact / Life)^(yr#-1))/Life   [where
fact is the declining balance factor expressed as a fraction and
yr# is the number of the year for which the depreciation is to be
computed].

Sum-of-the Years' Digits:

SOYD = (Basis - Salv) * (Life - yr# + 1) / (Life * (Life + 1) / 2)

===

Downloading the Financial Functions Library
software to the HP-48SX.

Each TDS memory card comes with the Financial Functions Library
software recorded in the RAM card. A copy of the library is also
stored on the disk which came with the product. Should you ever
lose the library in your HP-48SX, you can download it back to the
HP-48SX from an IBM PC compatible computer. The following three
files are pertient for downloading the Financial Functions
Library to your HP-48SX:

     KERMIT.EXE   - the data transfer program.
     FIN1   - library number 804.
     FIN2   - library number 805.

Downloading procedure from the floppy disk.

1). Insert the floppy disk in your floppy drive and at the DOS
prompt, type [A] [:] [Return].

2). Plug in your HP-48SX into either Port1 or Port2 of your PC.

Next, you need to set up your HP-48SX to receive the library from
your PC with the proper communication parameters.

3). Press [left-shift] [I/O]. Then press [SETUP]. The screen will
appear as:

                    I/O setup menu
              IR/wire: wire
              ASCII/binary: binary
              baud: 9600
              parity: none 0
              checksum type: 3
              translate code: 1

     [IR/W][ASCII][BAUD][PARIT][CHSM][TRAN]

If the values of the parameters in the screen are not as shown on
the right hand side of the illustration above, you should press
the softkeys associated with the parameters for which the values
are different than those shown. This will allow you to scroll
through the various choices until the values match those as shown
above. For example, if the baud is shown as 1200, press the
 [BAUD]   softkey three times will set the baud to 9600.

4). On your PC, type KERMIT [Return]. The prompt will be Kermit-
MS>.

5). On your PC, type SET PORT 1 (or 2 depending on the port on
your PC in which you have your cable connected) [Return].

6). On your PC, type SET BAUD 9600 [Return].

7). On your PC, type SET PARITY NONE [Return].

8). On your 48, press [left-shift] [I/O]. Then press [RECV].

9). On your PC, type SEND FIN1 [Return].

10). Once the transfer is complete, press [VAR]. The [FIN1] variable should appear as a softkey.

11). Press [FIN1].

12). Press[x] [STO] { where x is the port number into which you want to store the library; x can be 0, 1, or 2; port 0 is the merged memory }. Specify the number of the port into which you have placed your RAM card.

13). The variable "FIN1' is no longer needed in your 48. To free memory, you   should delete it. Press [VAR] ['] [FIN1] [left-shift] [PURGE].

14). On your 48, press [left-shift] [I/O]. Then press [RECV].

15). On your PC, type SEND FIN2 [Enter].

16). Once the transfer is complete, press [VAR]. The [FIN2] variable should appear as a softkey.

17). Press [FIN2].

18). Press [x] [STO] { where x is the port number into which you want to store the libarary}. Specify the number of the port into which you have placed your RAM card.

19). The variable "FIN2" is no longer needed in your 48. To free memory, you should delete it. Press [VAR] ['] [left-shift] [PURGE].

20). On your PC, type Q [Enter].

21). Now the downloading is completed. In order to configure the library in your HP-48SX, you need to turn the HP-48SX off and then on.