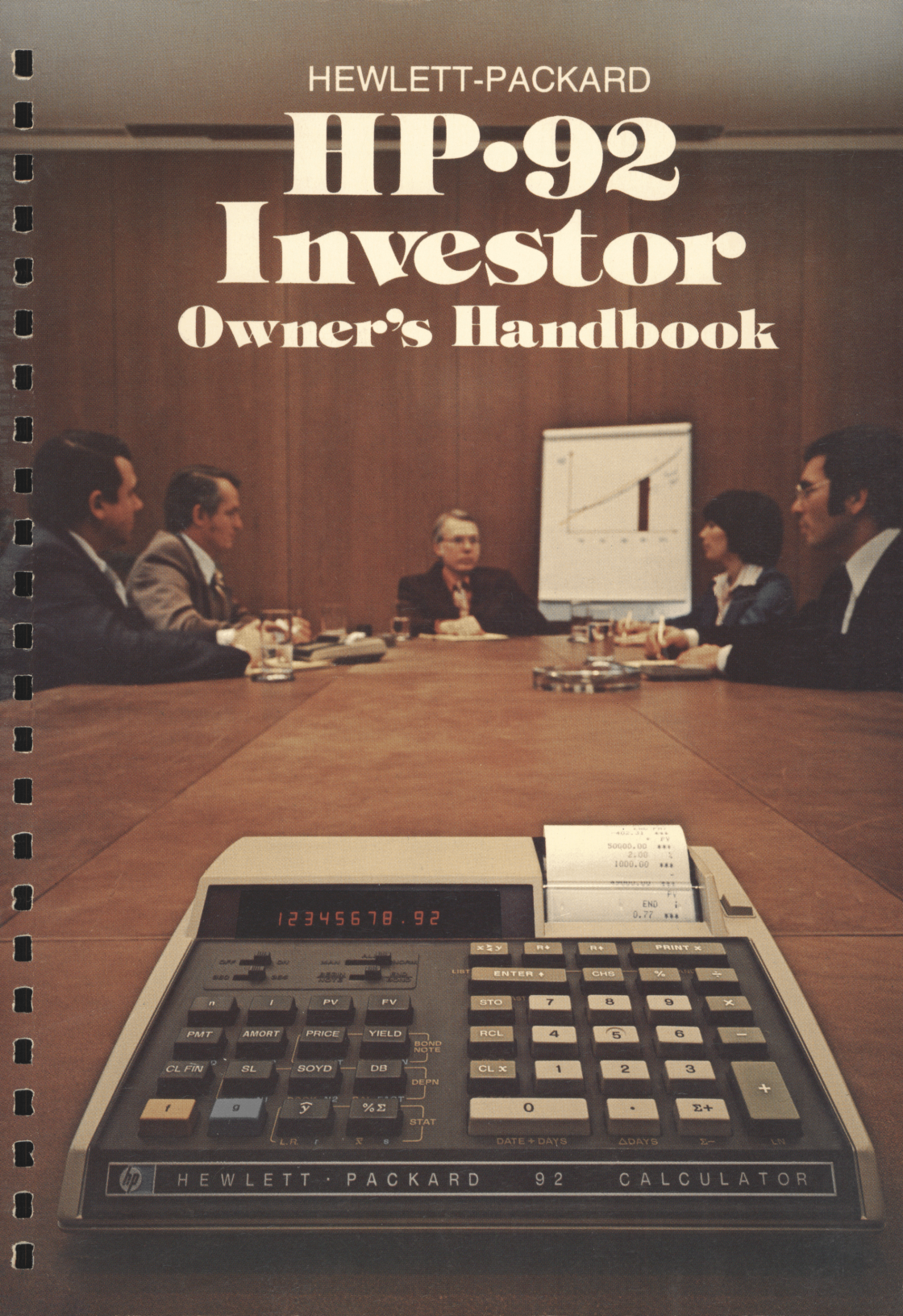
HEWLETT-PACKARD

HP-92 Investor

Owner's Handbook



"The success and prosperity of our company will be assured only if we offer our customers superior products that fill real needs and provide lasting value, and that are supported by a wide variety of useful services, both before and after sale."

Statement of Corporate Objectives.
Hewlett-Packard

We wish to thank the following people for their contributions in the preparation of this manual:

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When Messrs. Hewlett and Packard founded our company in 1939, we offered one superior product, an audio oscillator. Today, we offer more than 3,500 quality products, designed and built for some of the world's most discerning customers.

Since we introduced our first calculator in 1967, we've sold millions world-wide, both pocket and desktop models. Their owners include Nobel laureates, astronauts, mountain climbers, businessmen, doctors, students, and housewives.

Each of our calculators is precision crafted and designed to solve the problems its owner can expect to encounter throughout a working lifetime.

HP calculators fill real needs. And they provide lasting value.

Front cover display photographed separately to simulate typical appearance.

The HP-92 Investor Financial Printing Calculator

Owner's Handbook

July 1977

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The HP-92 Investor

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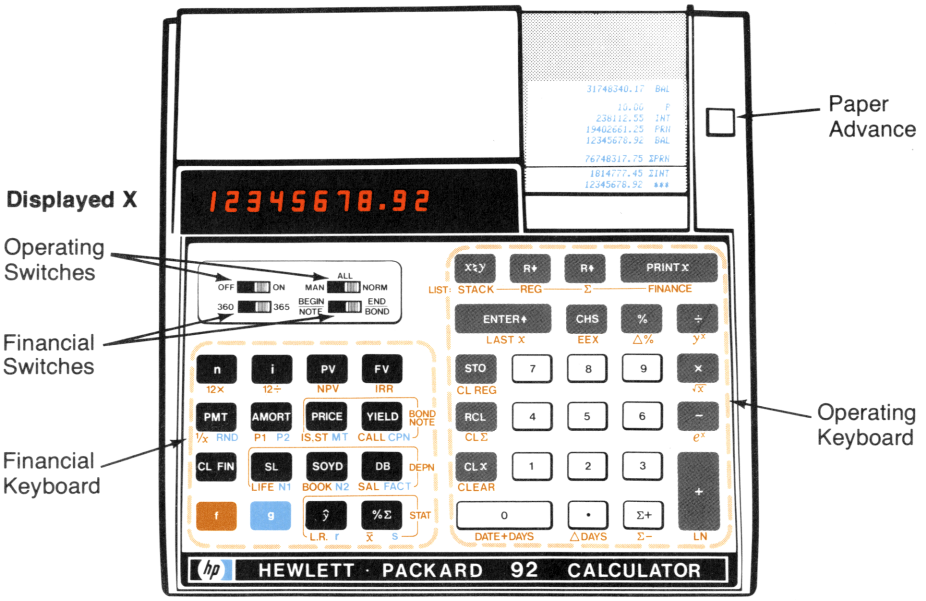


Addressable Storage Registers

R_0 R_1 R_2 R_3 R_4 R_5 R_6 R_7 R_8 R_9

$R_{.0}$ $R_{.1}$ $R_{.2}$ $R_{.3}$ $R_{.4}$ $R_{.5}$ $R_{.6}$ $R_{.7}$ $R_{.8}$ $R_{.9}$

Statistical Registers

$R_{\Sigma 0}$ $R_{\Sigma 1}$ $R_{\Sigma 2}$ $R_{\Sigma 3}$ $R_{\Sigma 4}$ $R_{\Sigma 5}$ $R_{\Sigma 6}$ $R_{\Sigma 7}$ $R_{\Sigma 8}$ $R_{\Sigma 9}$

Shared Financial Registers

n	LIFE	(AUX)
i	FACT	YIELD
PV	BOOK	PRICE
FV	SAL	CPN
PMT	—	ST
P1	N1	MT
P2	N2	IS
—	—	CALL

Function and Key Index

☐ Paper advance push-button. Press to advance paper without printing **(page 16).**

OFF ON Power switch **(page 13).**

ALL
MAN NORM Print Mode switch. Controls printing of keyboard operations **(page 16).**

360 365 Day Basis switch used in calendar and bond/note calculations **(page 26).**

BEGIN BOND END NOTE Payment Mode switch selects timing of payments in compound interest calculations OR selects computational procedure for interest bearing securities **(page 26).**

f Shift key. Selects alternate function in gold below function keys **(page 15).**

g Shift key. Selects alternate function in blue below function keys **(page 15).**

Percentage

% Computes x% of y and retains the y value in the Y-register **(page 53).**

Δ% Computes percent of change between number in Y-register and number in displayed X-register **(page 54).**

%Σ Computes percent that x is of the number (Σx) in storage register R_{Σ_1} **(page 55).**

Number Manipulation

ENTER↑ Enters a copy of number in displayed X-register into Y-register. Used to separate numbers **(page 85).**

CHS Changes sign of number or exponent of 10 in displayed X-register **(page 16).**

x≷y Exchanges contents of X- and Y-registers of stack **(page 88).**

R↓ Rolls down contents of stack for viewing in displayed X-register **(page 86).**

R↑ Rolls up contents of stack for viewing in displayed X-register **(page 86).**

CL x Clears contents of displayed X-register to zero **(page 88).**

CLEAR Clears contents of stack (X, Y, Z, T), all storage registers, statistical registers, and financial registers **(page 88).**

CL FIN Clears contents of financial registers **(page 26).**

LIST: FINANCE Prints the contents of the financial register group designated by the last financial key pressed **(page 24).**

EEX Enter exponent. After pressing, next numbers keyed in are exponents of 10 **(page 83).**

PRINT x Prints contents of displayed X-register **(page 16).**

RND Rounds mantissa of 10-digit number in X-register to actual value seen in the display **(page 78).**

LIST: STACK Causes printer to list contents of stack **(page 86).**

0 through 9 Digit used for keying in numbers and display formatting **(page 15).**

Manual Storage

STO Stores displayed value in one of 30 storage registers **(page 20).**

RCL Recalls (copies) stored number onto display **(page 21).**

CL REG Clears contents of the 20 non-statistical storage registers **(page 95).**

LIST: REG Causes printer to list contents of 20 non-statistical storage registers (R_0 through R_9, $R_{.0}$ through $R_{.9}$) **(page 94).**

LAST x Recalls number displayed before the previous operation back into the displayed X-register **(page 93).**

Logarithmic and Exponential

y^x Raises number in Y-register to power of number in displayed X-register **(page 76).**

e^x Natural antilogarithm. Raises e (2.718281828) to power of number in displayed X-register **(page 76).**

LN Computes natural logarithm (base e 2.718281828) of number in displayed X-register **(page 75).**

Arithmetic

$\sqrt{x}$ Computes square root of number in displayed X-register **(page 77).**

+ − × ÷ Arithmetic operators **(page 17).**

1/x Computes reciprocal of number in displayed X-register **(page 78).**

Statistics

Σ+ Accumulates numbers from X- and Y-registers into statistical storage registers R_{Σ_0} through R_{Σ_5} **(page 67).**

Σ− Subtracts x and y values from statistical storage registers R_{Σ_0} through R_{Σ_5} for correcting Σ+ accumulations **(page 68).**

[CLΣ] Clears statistical storage registers R_{Σ_0} through R_{Σ_9} to zero **(page 95.)**

LIST: [Σ] Causes printer to list contents of Σ registers (R_{Σ_0} through R_{Σ_9}) **(page 68).**

[x̄] Computes mean (average) of x and y values accumulated by [Σ+] **(page 68).**

[s] Computes sample standard deviations of x and y values accumulated by [Σ+] **(page 70).**

[L.R.] Linear regression. Computes y-intercept (A) and slope (B) for x and y data points accumulated using [Σ+] **(page 71).**

[ŷ] Linear estimate. With set of x, y data points accumulated using [Σ+], computes estimated y for new x **(page 73).**

[r] Product moment correlation coefficient. Computes strength of linear relationship among a set of x, y data points (Σ+) **(page 72).**

Calendar

[DATE+DAYS] Changes a date in the Y-register by the number of days in the X-register **(page 58).**

[△DAYS] Computes number of days between two dates in the Y- and X-registers **(page 57).**

Compound Interest

[n] Stores or computes number of periods in a financial problem **(page 23).**

[12×] Multiplies displayed X-register by 12 and stores the resulting value in the n-register **(page 34).**

[i] Stores or computes interest rate per compounding period **(page 23).**

[12÷] Divides displayed X-register by 12 and stores the resulting value in the i-register **(page 34).**

[PV] Stores or computes present value (initial cash flow) at the beginning of a financial problem **(page 29).**

[FV] Stores or computes future value (final cash flow) at the end of a financial problem **(page 29).**

[PMT] Stores or computes payment amount **(page 29).**

[AMORT] Generates amortization schedule using values stored in [i], [PV], [PMT], [P1], and [P2] **(page 43).**

[P1] Stores beginning period for amortization schedule **(page 43).**

[P2] Stores ending period for amortization schedule **(page 43).**

[NPV] Calculates the net present value of up to 30 uneven cash flows **(page 37).**

[IRR] Calculates the internal rate of return (yield) for up to 30 uneven cash flows **(page 39).**

Bonds/Notes

[PRICE] Stores or computes price of bond or note using values stored in [YIELD], [IS.ST], [MT], [CALL], and [CPN]. Also computes accrued interest when computing price of bond or note **(page 62-64).**

[YIELD] Stores or computes the yield (percentage) of a bond or note using values stored in [PRICE], [IS.ST], [MT], [CALL], and [CPN] **(page 62-64).**

[IS.ST] Stores the issue and settlement dates of bond and note calculations **(page 62-64).**

[MT] Stores the maturity date of a bond or note **(page 62-64).**

[CALL] Stores the call price or redemption value (if it is not 100) of a bond or note **(page 62-64).**

[CPN] Stores the coupon amount (percentage) for bond or note calculations **(page 62-64).**

Depreciation

[SL] Calculates a depreciation schedule using the straight-line method and values stored in [BOOK], [LIFE], [SAL], [N1], and [N2] **(page 45).**

[SOYD] Calculates a depreciation schedule using the sum-of-the-years'-digits method and values stored in [BOOK], [LIFE], [SAL], [N1], and [N2] **(page 46).**

[DB] Calculates a depreciation schedule using the declining balance method and values stored in [BOOK] [LIFE], [SAL], [N1], [N2] and [FACT] **(page 47).**

[BOOK] Stores the book value of an asset. Used in calculating depreciation schedules **(page 48).**

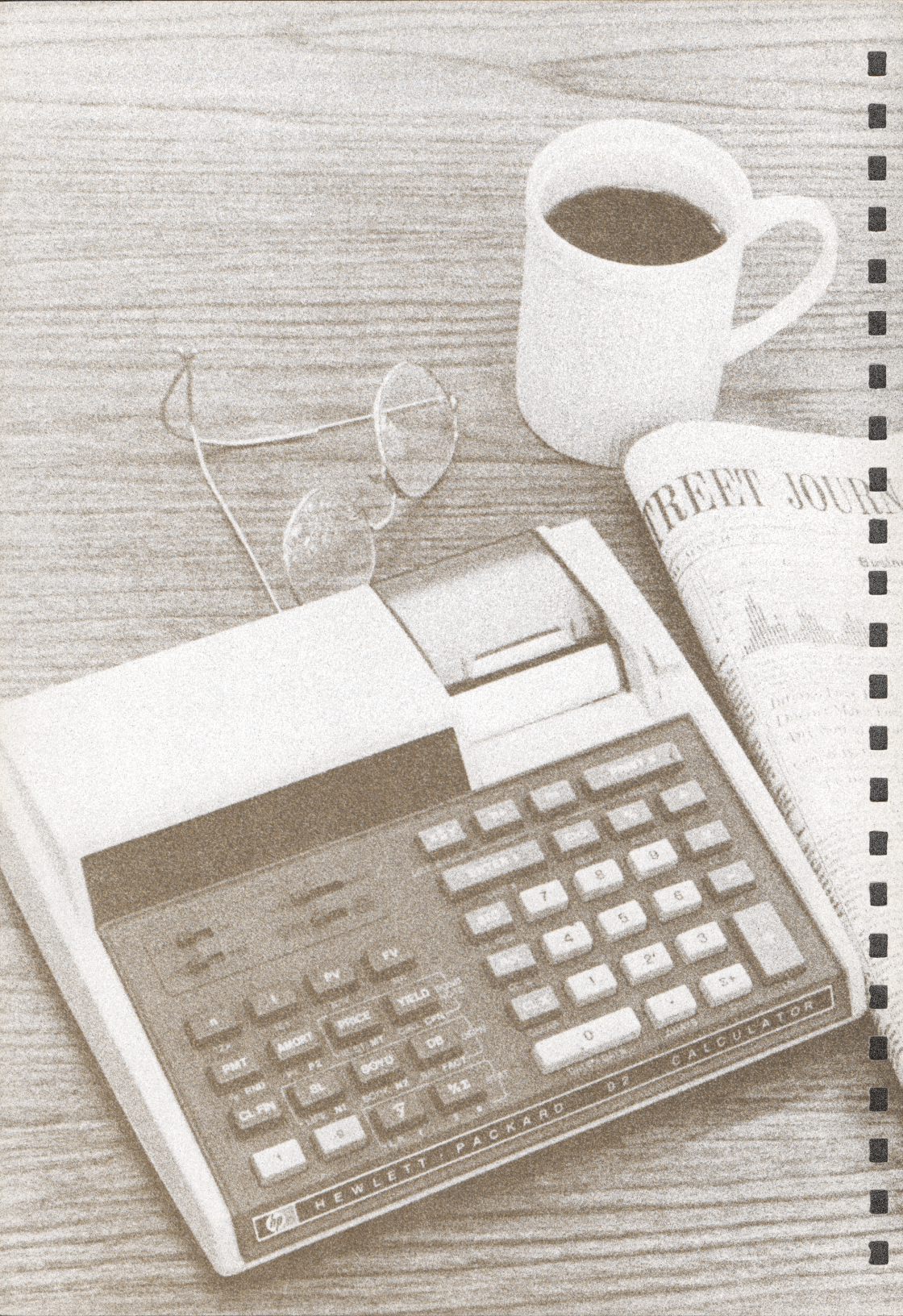
[FACT] Stores the declining balance depreciation factor (percentage) **(page 47-48).**

[LIFE] Stores the depreciable life (years) of an asset. Used in calculating depreciation schedules **(page 48).**

[SAL] Stores the salvage value of an asset. Used in calculating depreciation schedules **(page 48).**

[N1] Stores the starting year for a depreciation schedule **(page 48).**

[N2] Stores the ending year for a depreciation schedule **(page 48).**


REET JOUR
HEWLETT-PACKARD 22 CALCULATOR

Meet the HP-92 Investor

Congratulations!

You've just made a wise investment, one that will save you money today, next week, and next year. Your HP-92 Investor is another professional-quality business calculator from Hewlett-Packard—the maker of calculators whose ease of operation and financial power have made them the choice of Realtors, mortgage and commercial bankers, stockbrokers, investment consultants, and managers who require fast, accurate answers. Hundreds of thousands of HP financial pocket calculators are in use throughout the world, in fact, you might already own one!

Amortization tables and depreciation schedules are all preprogrammed in the HP-92, ready at your fingertips. While your new calculator solves complex bond, real estate, and investment problems, it provides a printed record as well. And if your work doesn't end when the office closes, take the HP-92 along with you. Battery power and attache-case fit make your HP-92 completely portable.

The secret to getting the most from your HP-92 lies in taking the time to read through this handbook, working the problems as you go along. More complex and specialized financial calculations are presented in the *HP-92 Applications Book*.

The more confidence you have in your HP-92 calculator and your own understanding of it, the more profitably you will use it. So, let's see what the HP-92 can do.

Example: If you deposit $10,000 in a fund that pays 7.75% annual interest, how much could you withdraw 12 years later?

Set the Payment Mode switch 

to END.

Press	Display	
CL FIN		This clears the financial registers.
12 n	12.00	Number of years.
7.75 i	7.75	Periodic interest rate.
10000 CHS PV	-10000.00	You are giving money to the bank, so you key it in as negative.
FV	24491.05	The amount you could withdraw in 12 years.

How much would you be able to withdraw in 12 years if, in addition to the original deposit, you also made $1000 yearly payments?

Press	Display	
1000 CHS PMT	*-1000.00*	The payment is again negative because you are giving money to the bank.
FV	*43189.17*	Amount you could withdraw after 12 years.

If you wanted instead to withdraw $45,000 at the end of the 12 year period, how much would you need to deposit each year?

Press	Display	
45000 FV	*45000.00*	At the end of 12 years you will receive $45,000.
PMT	*-1096.85*	You must deposit this amount annually.

However, you can only afford to deposit $1050 per year. Given these requirements, how much annual interest would the fund need to pay to achieve your goal?

Press	Display	
1050 CHS PMT	*-1050.00*	You can deposit $1050 per year.
i	*7.97*	Annual interest rate required.

In this example, you have used the financial keys 10 times to get 4 different answers—without resetting, re-entering or clearing during the problems! The powerful HP-92 simplifies complex problems and puts answers at your fingertips.

The HP-92 Investor


PV
FV
NPV
PRICE
SL
SOYD
DB
BOOK
FACT

Section 1

Getting Started

Power On

Your HP-92 is shipped fully equipped, including a battery pack.

Although the calculator is completely portable, if you want to use your HP-92 on battery power alone, you should connect the ac adapter/recharger and *charge the battery pack for 7 hours*. Whether you operate from battery power or from the ac adapter/recharger, *the battery pack must always be in the calculator*. The battery pack is never in danger of being overcharged, even if it gets warm.

To begin: Slide the OFF-ON switch OFF ▮▯ ON to ON.

Slide the Print Mode switch MAN ▮▯ ALL NORM to NORM.

Display

Numbers that you key into the calculator as well as intermediate and final answers are always seen in the bright, red display. When you first turn the calculator ON, the display is set to ***0.00***.

Clearing

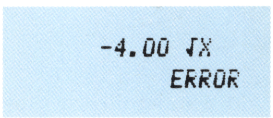
You can clear any numbers that are in the display by pressing CL x *(clear x)*. This key erases the number in the display and replaces it with ***0.00.*** If you make a mistake while keying in a number, clear the entire number string by pressing CL x. Then key in the correct number.

Error Display

If you happen to key in an improper operation, the word ***Error*** will appear in the display. In addition, the printer will print ERROR if the Print Mode switch MAN ▮▯ ALL NORM is set to NORM or ALL.

For example, if you attempt to calculate the square root of –4, the HP-92 will recognize it as an improper operation:

Press	Display
4 CHS	*–4.*
f √x	*Error*

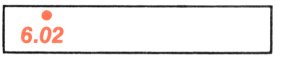


When ***Error*** is displayed, pressing *any* key clears the error. The key pressed does nothing but restore the calculator to the condition that existed prior to the error. If you are unsure of what caused the error, see appendix B for help.

Press	Display
CL X	-4.00

Low Power Display

When you are operating the HP-92 from battery power, a red lamp inside the display will glow to warn you that the battery is almost exhausted.



Low Power Display

You must then connect the ac adapter/recharger to the calculator and operate from ac power, or you must substitute a fully charged battery pack for the one that is in the calculator. Refer to appendix A for a description of these operations.

Overflow and Underflow Displays

Any attempt to enter or calculate numbers larger in magnitude than $9.999999999 \times 10^{99}$ will stop the calculation and display **9.999999999 99** for positive numbers or **-9.999999999 99** for negative numbers.

Any attempt to enter or calculate numbers closer to zero than 10^{-99} will produce zero.

Change in Format

When the calculator is turned on, the calculator is set to round displayed numbers to two decimal places. Although you see only two decimal places, the HP-92 actually calculates all numbers internally to full 10-digit accuracy. The HP-92 rounds up at a value of five and over. For example, 1.456 is rounded to 1.46 and 1.444 is rounded to 1.44.

If you wish to see more than two decimal places, you may select either fixed point display or scientific notation display.

Press	Display	
1.23456789 ENTER↑	1.23	ENT↑

If you wish to display the internal number rounded to 4 decimal places, press g 4 (four digit fixed point notation).

Press	Display
g 4	1.2346

Why does the display show 1.2346 rather than 1.2345? Because the number has been *rounded* (not *truncated*) to 4 decimal places.

To display the number in scientific notation:

Press	Display	
g .	1.234567890 00	More about scientific notation later.

Scientific notation display is covered in detail on page 82.

Remember, regardless of the display format you choose, the HP-92 calculates internally to full 10-digit accuracy. For additional information about display formatting, refer to section 8.

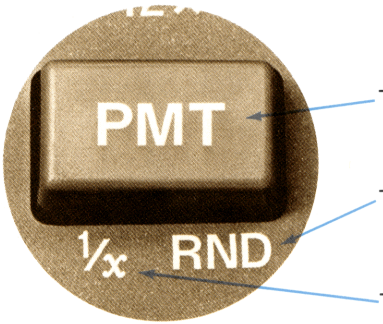
Let's set the display back to two decimal fixed point display before we continue.

Press	Display
g 2	*1.23*

Keyboard

Most keys on the HP-92 perform two or three functions. One function is indicated by the symbol on the key face; the second function is indicated by the gold symbol below the key; and the third function is indicated in blue below the key.

- To select the function on the face of the key, press the key.
- To select the function printed in gold below the key, press the gold prefix key f then press the function key.
- To select the function printed in blue below the key, press the blue prefix key g then press the function key.



To execute the payment PMT function, press PMT.

To execute the rounding RND function, press g RND.

To execute the reciprocal 1/x function, press f 1/x.

In this handbook, the selected key function will appear in the appropriate color outlined by a box, like this: PMT, 1/x, RND.

Keying In Numbers

Key in numbers by pressing the number keys in sequence, just as though you were writing on a piece of paper. The decimal point must be keyed in if it is part of the number (unless it is to the right of the last digit).

For example, to key in 148.84:

Press	Display
1 4 8 • 8 4	*148.84*

The number 148.84 is seen in the display.

Negative Numbers

To key in a negative number, press the keys for the number, then press CHS *(change sign)*. The number, preceded by a minus (–) sign, will appear in the display. For example, to change the sign of the number now in the display:

Press	Display
CHS	*–148.84*

You can change the sign of either a negative or a positive nonzero number in the display. For example, to change the sign of the –148.84 now in the display back to positive:

Press	Display
CHS	*148.84*

Notice that only negative numbers are given a sign in the display.

Printer

The printer has three modes of operation, which you control using the Print Mode switch MAN ALL NORM.

With the Print Mode switch MAN ALL NORM set to MAN *(manual)*, the printer is idle and does not print unless you press the PRINT x key or one of the four LIST functions. This mode gives greatest economy of paper and battery power.

With the Print Mode switch MAN ALL NORM set to NORM *(normal)*, the calculator records a history of the calculation sequence so that you can reconstruct your problem. In this mode you see digit entries and functions, but intermediate and final results are not printed unless you press the PRINT x key.

With the Print Mode switch MAN ALL NORM set to ALL, the calculator prints numbers, functions, and intermediate and final results, just as they are seen in the display. The results of functions are printed with the symbol *** to the right of the number.

To advance the printer paper, press the paper advance pushbutton that is located to the right of the paper output. Don't worry if the display blanks out while the paper advance is operating—this is normal. To advance the paper more than one space, simply hold the pushbutton down until the paper has advanced the desired amount. To replace the paper roll, refer to appendix A of this handbook.

If you run out of paper during a calculation, your HP-92 will continue to calculate all of the desired results. Final results that have been stored in the operational stack can be displayed using the R↓ or R↑ keys. For additional information, refer to Manipulating Stack Contents (page 86).

One- and Two-Number Functions

The best way to see how functions operate on your HP-92 is with the Print Mode switch set to ALL to give you a complete record of inputs, functions, and answers.

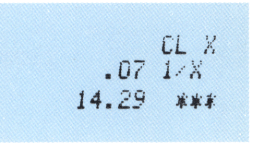
Slide the Print Mode switch MAN [ALL] NORM to ALL.

Despite the dozens of functions available on the HP-92, you will find them simple to use by following a single, all-encompassing rule: *When you press a function key, the calculator immediately executes the function written on the key.*

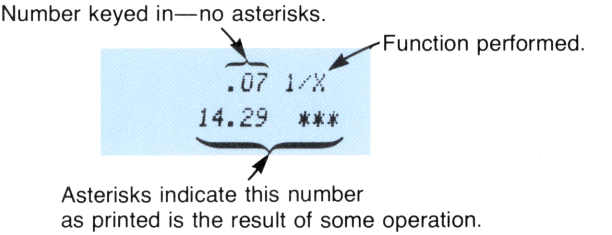
> Pressing a function key causes the calculator to immediately perform that function.

For example, to calculate the reciprocal of .07:

Press	Display
CL X	
.07	*.07*
f 1/x	*14.29*



The paper tapes are printed just as you read, from left to right and top to bottom. The number, .07, is printed exactly as you keyed in it. A symbol for the function performed, 1/x, is printed next to it. The answer, 14.29, is printed with a three-asterisk label to its right, indicating that the HP-92 performed some operation in order to obtain the number as it is printed.



1/x is an example of a one-number function key; that is, a key that executes upon a single number. Arithmetic function keys involve two numbers.

Two-number functions are functions that must have two numbers present in order for the operation to be performed. +, −, ×, and ÷ are examples of two-number function keys. You cannot add, subtract, multiply, or divide unless there are two numbers present in the calculator. Two-number functions work the same way as one-number functions—that is, the operation occurs when the function key is pressed. Therefore, *both numbers must be in the calculator before the function key is pressed.*

When more than one number must be keyed into the calculator before performing an operation, the ENTER↑ key is used to separate the two numbers.

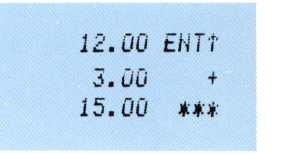
> Use the ENTER↑ key whenever more than one number must be keyed into the calculator before pressing a function.

If you key in only one number, you never need to press ENTER↑. To place two numbers into the calculator and perform an operation:

1. Key in the first number.
2. Press ENTER↑ to separate the first number from the second.
3. Key in the second number.
4. Press the function key to perform the operation.

For example, to add 12 and 3:

Press	Display	
12	*12.*	The first number.
ENTER↑	*12.00*	Separates the first number from the second.
3	*3.*	The second number.
+	*15.00*	The function.



Other arithmetic functions are performed the same way:

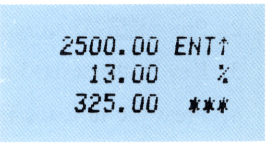
To perform	Press	Display
12 − 3	12 ENTER↑ 3 −	*9.00*
12 × 3	12 ENTER↑ 3 ×	*36.00*
12 ÷ 3	12 ENTER↑ 3 ÷	*4.00*

The % key is also a two-number operation, and you can use it in the same way that you use every other two-number function key:

1. Key in the first number (base).
2. Press ENTER↑ to separate the first number from the second.
3. Key in the second number (rate).
4. Press % to perform the operation.

Thus, to calculate 13% of 2500:

Press	Display
2500	2500.
ENTER↑	2500.00
13	13.
%	325.00



The operational speed and simplicity of the HP-92 are most apparent during chain calculations. Even during the longest of calculations, *you still work with only one or two numbers at a time*—the unique Hewlett-Packard automatic memory stores intermediate results until you need them, then inserts them into the calculation. The process of working through a problem is as natural as it would be if you were working it out with pencil and paper, but the calculator takes care of the hard part.

For example, solve $7 \times (12 + 3)$.

If you were working the problem with a pencil and paper, you would first calculate the intermediate result of $(12 + 3)$...

$$7 \times (\overset{15}{\cancel{12 + 3}})$$

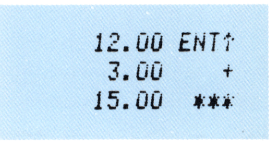
...and then you would multiply the intermediate result by 7.

$$7 \times (\overset{15}{\cancel{12 + 3}})$$

You work through the problem exactly the same way with the HP-92, never working with more than two numbers at a time. You solve for the intermediate result first...

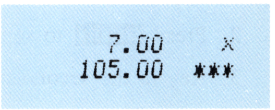
$$(12 + 3)$$

Press	Display
12	12.
ENTER↑	12.00
3	3.
+	15.00



...and then solve for the final answer. You don't need to press ENTER↑ to store the intermediate result—the HP-92 stores it automatically when you key in the next number. To continue...

Press	Display	
7	7.	The intermediate result from the preceding operation is automatically stored when you key in this number.
×	105.00	Pressing the function key gives you the final answer.



Now try these problems. Notice that you only have to press ENTER↑ to insert the first pair of numbers into the calculator—each subsequent operation is performed using a new number and an automatically stored intermediate result.

To solve:	Press:	Display
$\frac{(2 + 3)}{10}$	2	2.
	ENTER↑	2.00
	3	3.
	+	5.00
	10	10.
	÷	0.50
$(16 - 4) \times 3$	16	16.
	ENTER↑	16.00
	4	4.
	−	12.00
	3	3.
	×	36.00
$\frac{14 + 7 + 3 - 2}{4}$	14	14.
	ENTER↑	14.00
	7	7.
	+	21.00
	3	3.
	+	24.00
	2	2.
	−	22.00
	4	4.
	÷	5.50

```
 2.00 ENT↑
 3.00   +
 5.00  ***
10.00   ÷
 0.50  ***

16.00 ENT↑
 4.00   -
12.00  ***
 3.00   x
36.00  ***

14.00 ENT↑
 7.00   +
21.00  ***
 3.00   +
24.00  ***
 2.00   -
22.00  ***
 4.00   ÷
 5.50  ***
```

Even more complicated problems can be solved in the same simple manner, using the automatic storage of intermediate results. For additional practice in doing chain calculations and a more thorough explanation of how the intermediate answers are stored and used, turn to section 8—The Automatic Memory Stack (page 84).

Memory

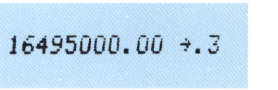
The HP-92 has 30 addressable memories (storage registers) that allow you to set aside numbers as constants or for use in later calculations. The addresses of the storage registers are indicated by number keys 0 through 9, by •0 through •9, and by Σ+0 through Σ+9.

To store a displayed number in a storage register:

1. Press STO *(store)*.
2. Press the number key of the desired register (R_0 through R_9, $R._0$ through $R._9$, or $R_{\Sigma 0}$ through $R_{\Sigma 9}$).

For example, to store 16,495,000 (the number of persons carried daily by the Japanese National Railway) in register $R._3$:

Press	Display
16495000	*16495000.*
STO ⊡ 3	*16495000.00*



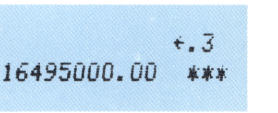
The number has been copied into storage register $R._3$ and also remains in the displayed X-register.

Numbers are recalled from storage registers back into the displayed X-register in much the same way as they are stored. To recall a number from any of the storage registers:

1. Press RCL *(recall)*.
2. Press the number key of the applicable register (R_0 through R_9, $R._0$ through $R._9$, or $R_{\Sigma 0}$ through $R_{\Sigma 9}$).

For example, to recall the number of persons carried daily by the Japanese National Railway:

Press	Display
RCL ⊡ 3	*16495000.00*



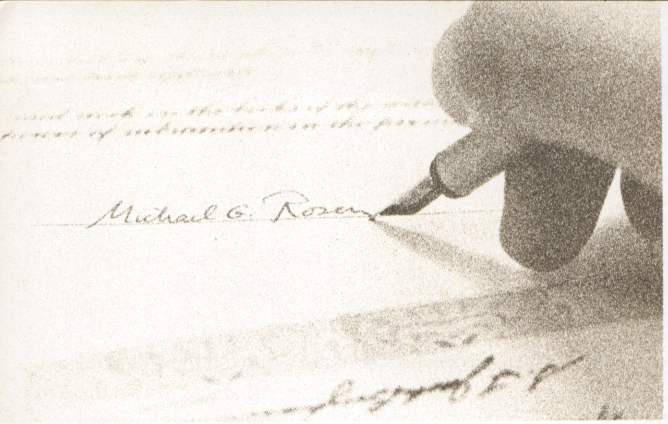
When you recall a number, it is copied from the storage register into the display, and it also remains in the storage register. For more information on the storage registers, see section 8.

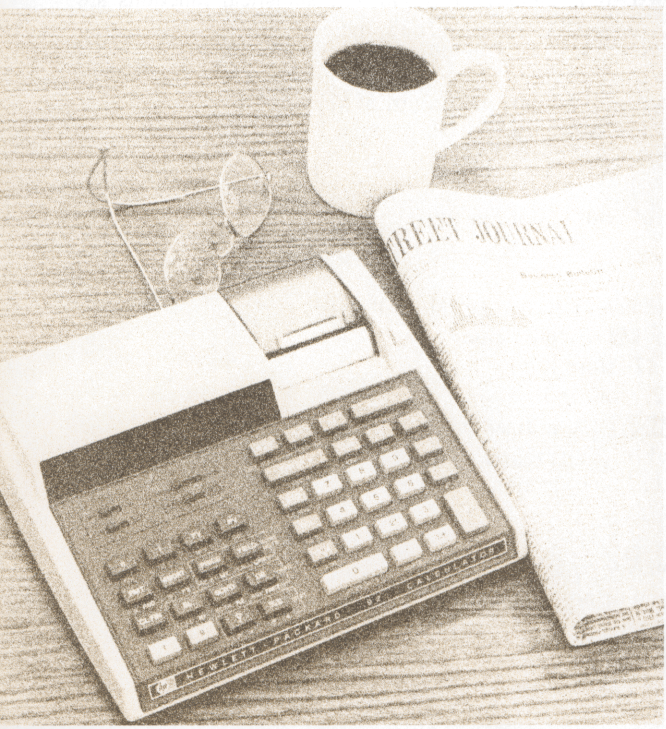
A Word About the HP-92

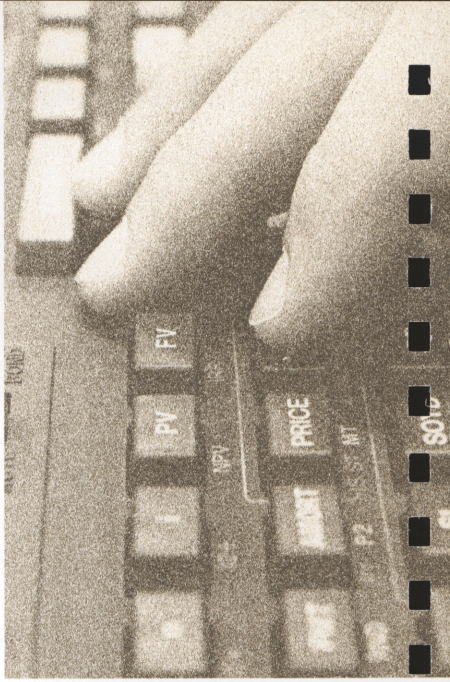
Now that you've learned how to use the calculator, you can begin to fully appreciate the benefits of the Hewlett-Packard logic system. With this system, you enter numbers using a parenthesis-free, unambiguous method called RPN.

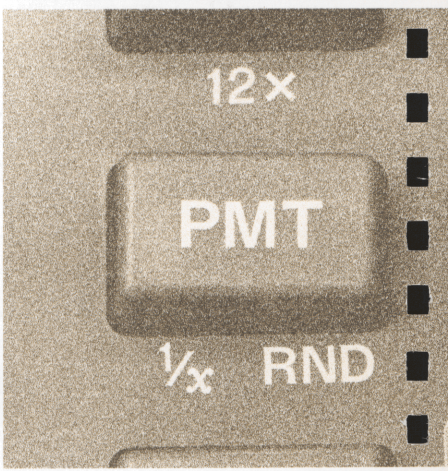
It is this unique system that gives you all these calculating advantages:

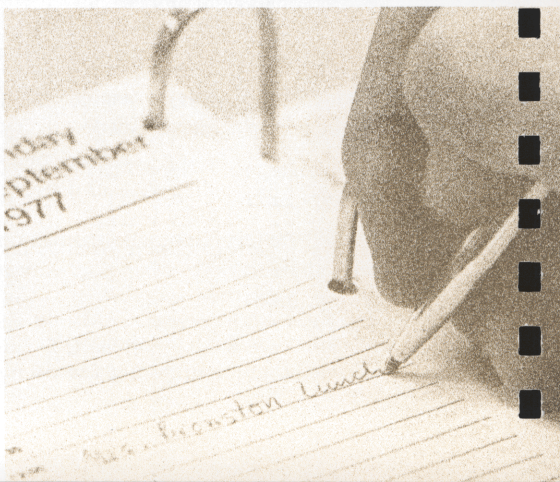
- You never have to work with more than one function at a time. The HP-92 cuts problems down to size instead of making them more complex.
- Pressing a function key immediately executes the function. You work naturally through complicated problems, with fewer keystrokes and less time spent.
- Intermediate results appear as they are calculated. There are no "hidden" calculations, and you can check each step as you go.
- Intermediate results are automatically displayed. You don't even have to print out long intermediate answers when you work a problem. (Of course, if you want intermediate answers, the HP-92 printer will record them in ALL mode.)
- You can calculate in the same order that you do with pencil and paper. You don't have to think the problem through ahead of time.


Michael G. Rosen


STREET JOURNAL


FV
PV
PRICE


12×
PMT
1/x RND



SECTION 2

The Financial Keyboard

The HP-92 calculator has two keyboards (the operating keyboard on the right and the financial keyboard on the left), two financial switches, and two operating switches (located above the financial keyboard). Note that when some complex financial and statistical functions are performed, the display will blink on and off for several seconds indicating that the calculation is being performed.

The financial keyboard is comprised of the following groups of keys:

Row 1 Discounted Cash Flow Analysis:

- NPV (Net present value)[1]
- IRR (Internal rate of return, store in i)

Rows 1 and 2 Compound Interest:

- n (Periods)[2] i (Interest rate per period –%)[2]
- PV (Present value)[2] FV (Future value)[2]
- 12× (Multiply by 12, store in n)
- 12÷ (Divide by 12, store in i)
- PMT (Payment) AMORT (Amortization)[1]
- P1 (Starting period of amortization schedule)[3]
- P2 (Ending period of amortization schedule)[3]

Row 2 Bond and Note:

- PRICE (Price of bond or note)[2]
- YIELD (Yield of bond or note –%)[2]
- IS,ST (Issue and settlement dates)[3]
- MT (Maturity date)[3]
- CALL (Call price)[3] CPN (Coupon –%)[3]

Row 3 Depreciation:

- SL (Straight-line method)[1]
- SOYD (Sum-of-years'-digits method)[1]
- DB (Declining-balance method)[1]
- LIFE (Life of asset)[3]
- N1 (Starting year of depreciation schedule)[3]
- N2 (Ending year of depreciation schedule)[3]
- BOOK (Book value)[3] SAL (Salvage value)[3]
- FACT (Declining balance factor –%)[3]

1. Solve-only function (no corresponding financial register).
2. Solve and store function (has corresponding financial register).
3. Store-only function (has corresponding financial register).

Row 4 Statistics (all are solve-only functions):
ŷ (Linear estimate) %Σ (Percent of Σx)
L.R. (Linear regression coefficients)
r (Correlation coefficient)
x̄ (Means) s (Sample standard deviations)

The Financial Registers

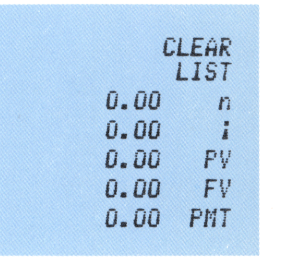
Eight special memories, called the financial storage registers, are reserved for groups of problems involving the compounded interest, bond/note, and depreciation calculations.* Each financial group shares these eight special registers (see page 6a). To enter data into a financial register simply key in the number and press the financial key. Some financial keys either store or solve (see page 23).

Listing the Financial Registers

The contents of the financial registers can be reviewed at any time by pressing f LIST: FINANCE. This prints the contents of the registers along with the appropriate keyboard labels. Because the registers are shared among three financial groups, the labels that are printed depend upon the group being utilized. **The calculator assumes that the last key pressed on the financial keyboard indicates the group to be printed.** After pressing CLEAR, CL FIN, or turning the power ON, the printer uses the compound interest group labels.

To list the compound interest financial registers:

Press	Display
f CLEAR	0.00
f LIST: FINANCE	0.00



* Discounted cash flow analysis utilizes the 30 general storage registers R_0 through R_9, $R._0$ through $R._9$, and R_{Σ_0} through R_{Σ_9}. Statistical calculations use R_{Σ_0} through R_{Σ_5}.

To list the BOND/NOTE group:

Press	Display	
PRICE	*0.00*	Switches to the BOND/NOTE labels.
f LIST: FINANCE	*0.00*	

```
          PRC
         LIST
 0.00     IS
 0.00     ST
 0.00     MT
100.00  CALL
 0.00    CPN
 0.00    PRC
 0.00    YLD
```

To list the Depreciation group:

Press	Display	
f BOOK	*0.00*	Switches to the Depreciation labels.
f LIST: FINANCE	*0.00*	

```
          BOOK
         LIST
 0.00    LIFE
 0.00    BOOK
 0.00     SAL
 0.00      N1
 0.00      N2
 0.00    FACT
```

Displaying Financial Values

Any of the values associated with the financial registers can be recalled by pressing RCL followed by the appropriate key. For example the value automatically stored in CALL can be recalled by pressing RCL f CALL.

Press	Display
RCL f CALL	*100.00*

```
          ←CALL
100.00     ***
```

Clearing the Financial Registers

If you are working with some different values in the same financial problem, it is not necessary to re-enter all of the values again. Simply key in the new data and overwrite the values in the financial registers. If you start a new problem, however, where all of the values differ from the previous problem, it is often best to completely clear the financial registers by pressing CL FIN. Clearing the registers means that the previous financial register values are overwritten with zeros (and a value of 100 is placed in CALL). The display remains unchanged.

Re-Entering Values

Because the shared storage registers are assigned to the keys associated with particular financial calculations, it is possible to do a series of calculations without re-entering any of the constant values. Once a value is stored in a particular register, it remains in the register for possible future use until it is either overwritten or the machine is switched OFF.

There are three ways to overwrite (and consequently change) a value stored in one of the financial registers.

1. Pressing CLEAR or CL FIN.
2. Keying in a different number and pressing the original key. This stores the new value in the place of the original value.
3. Pressing a key associated with a different functional group. Between groups, memory locations are shared, so entering a value using a key from a different group may overwrite the stored value and destroy it. A diagram showing register-key associations is presented on page 6a.

The Financial Switches

The financial switches 360 365 and BEGIN/NOTE END/BOND located above the financial keyboard are used in conjunction with the compound interest, and bond/note groups on the financial keyboard, and the calendar functions on the operating keyboard. When the calculation is affected by the position of one of these switches, the position is recorded by the printer.

The Day Basis Switch 360 365

Many financial calculations are based on the number of days in a calendar year. Some calculations utilize an idealized calendar that has 30 days in a month and 360 days in a year (30/360). Other calculations use the real calendar with the actual number of days in the month and 365 days in the year (actual/365). The Day Basis switch 360 365 tells the calculator which calendar to use. It affects the PRICE, YIELD, DATE+DAYS, and △DAYS functions.

The Payment Mode Switch BEGIN/NOTE END/BOND

This switch serves two independent purposes. When doing compound interest calculations it is used to differentiate between payments made at the beginning of the first period (BEGIN) or at the end of the first period (END). For a more thorough explanation, refer to page 30.

The Payment switch is used in securities calculations when the group of keys designated BOND-NOTE are used. The switch indicates whether a BOND or NOTE calculation is being done. A detailed explanation of the positioning of the payment switch during bond/note calculations is presented in Bond or Note? (page 61). The Payment switch affects the n, i, PV, FV, PMT, PRICE, YIELD, and IS,ST functions.

Section 3

Financial Interest Calculations

The Concept of Simple Interest

Many financial problems are based on the concept of charging a rental fee, called an interest charge, for the use of someone else's money for a fixed period of time. The English convention is to state the fee as a rate, using the word "percent," derived from the Latin "per" meaning "for each" and "cent" meaning "one hundred." An interest rate of eight percent per year can be restated as eight for each one hundred or eight dollars for each one hundred dollars borrowed for a year.

Simple Interest Calculations

If one were to borrow $500, called the principal, at a stated rate of each $8 for each $100 (8 percent) for one year, the interest amount would be $40 (5 times 8). Borrowing the same amount of money for only 3 months would cost ¼th as much, or $10 ($500 times 8 percent times ¼th of a year). Therefore the **interest amount** can be found by multiplying the **principal** times the **interest rate** times the **time.** The total amount is found by adding the principal and interest amounts.

Example: If you borrow $500.00 for one year at eight percent (.08) simple interest per year, what would be the interest amount? What would be the total cost of the loan? Set the Print Mode switch MAN ALL NORM to ALL so you can concentrate on the financial calculations.

$$I = \$500 \times .08 \times 1$$

Press	Display		
500 ENTER↑	*500.00*	The principle (P).	500.00 ENT↑
.08 ×	*40.00*	The interest amount.	.08 ×
500 +	*540.00*	The total cost of the loan.	40.00 ***
			500.00 +
			540.00 ***

What if you borrow the same amount of money for only 3 months? Since the time (T) is less than one year, you must calculate the portion T is of one year.

$$I = \$500 \times .08 \times (3 \div 12)$$

Press	Display	
500 ENTER↑	500.00	The principle (P).
.08 ×	40.00	The interest amount.
3 ENTER↑	3.00	
12 ÷	0.25	The portion of the year.
×	10.00	The interest amount.
500 +	510.00	The total cost of the loan.

```
500.00 ENT↑
   .08    ×
 40.00  ***
  3.00 ENT↑
 12.00    ÷
  0.25  ***
        ×
 10.00  ***
500.00    +
510.00  ***
```

Percentage calculations can be simplified by using the % key, which is covered in section seven.

The Concept of Compound Interest

Although the concept of simple interest underlies most financial transactions, its use in the business world usually differs somewhat from the problem presented in The Concept of Simple Interest. For example, suppose you invested $500 for 2 years at 8%. How much interest would your investment earn? Using simple interest, the answer would be $80; you receive $40 at the end of the first year, and $40 at the end of the second year.

What would happen, if at the end of the first year, the $40 of interest earned was invested for the second year along with the initial $500? At the end of the second year the $500 and $40 together would earn $43.20, $3.20 more than the initial $500 earned the first year. In effect, the interest is earning interest. Continuing this procedure, year after year, the amount invested continues to grow as well as the interest it earns.

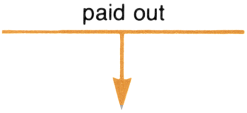
This method of re-investing earned interest is much more common in business transactions and is referred to as compounding the interest, or compound interest.

Compound Interest Calculations and the Cash Flow Diagram

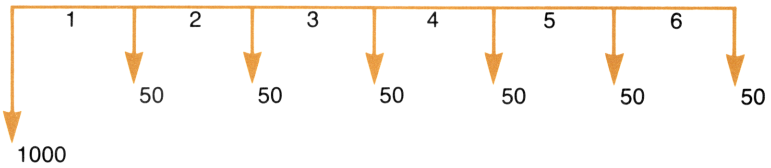
Although the concept of compound interest is not difficult, the computations involved can become exceedingly complex. Problems encountered often involve numerous payments and receipts before the transaction is concluded. The HP-92 is designed to solve many of the most complicated calculations, but it requires a precise format for describing the problem. Such a format can be represented pictorially in the form of a cash flow diagram. The diagram is nothing more than a description of the timing and direction in which cash changes hands using a terminology that corresponds to the HP-92 financial keyboard.

The diagram starts with a horizontal line called the time line. It represents the duration of a financial problem and is divided into compounding periods. For example a financial problem that transpires over 6 months with monthly compounding would look like this:

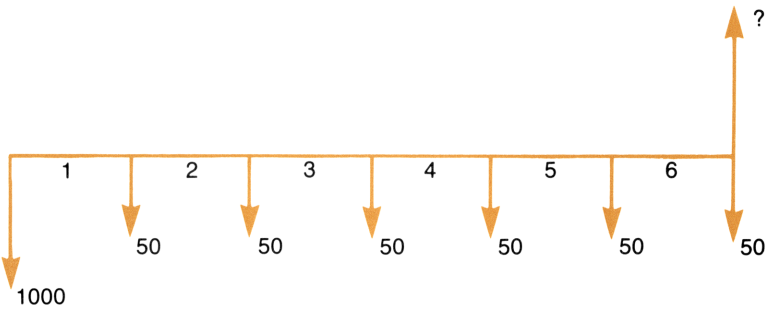
The exchange of money in a problem is pictured with vertical arrows; money received is represented with an arrow pointing up from the time line where the transaction occurred and money paid out is represented by an arrow pointing down.



For example, if you deposited (paid out) $1000 at the beginning of the time period and then deposited an additional $50 at the end of each month for the remaining 6 months, the diagram would look like the following:

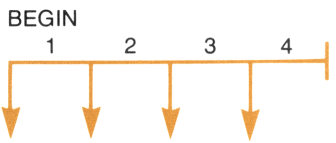


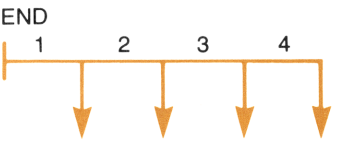
At the end of the period your account would have a balance that included the initial deposit, the subsequent payments, and any interest paid. This balance could be withdrawn, (received) if necessary and would represent a final cash exchange, completing the problem and the cash flow diagram.



On the keyboard of the HP-92 you will find the following keys in the first and second rows of the financial keyboard: PV, FV, and PMT. The PV (present value) represents the cash flow at the start of the time line. In our example PV would be the $1000 initial deposit. FV stands for future value and represents the cash flow at the end of the time line; in our example the amount that could be withdrawn at the end of the six months.

PMT (payment) represents a series of cash exchanges of the same direction and amount. Payments can either start at the beginning of each period (BEGIN), or start at the end of each period (END). There are always the same number of payments as periods.





Whenever payments (PMT) are involved, it is always necessary to specify which of the two alternatives is applicable by setting the Payment Mode switch BEGIN NOTE / END BOND, found above the financial keyboard, to the proper position. BEGIN for payments in advance and END for payments in arrears. Or BEGIN for annuities due and END for immediate (ordinary) annuities. In our example, the payments occur at the end of each period, so the payment switch must be placed in the END position before starting calculations.

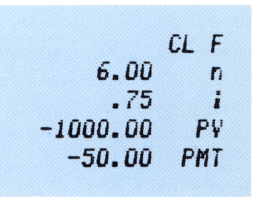
Cash received (arrow pointing up) is represented by a positive value (+), and cash paid out (arrow pointing down) is represented by a negative value (−). In our example, the $1000 initial transaction (PV), and the periodic $50 payments would both be negative values. The amount received at the end of the time span would be positive.

> **Note:** Cash received is represented by a positive value (+). Cash paid out is represented by a negative value (−). This convention applies to compound interest and discounted cash flow analysis calculations.

Now let's do the problem represented by the cash flow diagram and calculate the FV. Before beginning the calculation, one additional piece of information is necessary, the interest rate paid each compounding period. For this example let the interest rate, represented by the i key, be .75% per period. Remember, all cash that is paid out has a negative value.

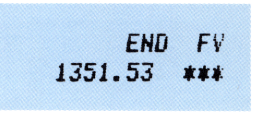
Since the $50 payments are made at the end of each period, set the Payment Mode switch BEGIN NOTE / END BOND to END.

Press	Display	
CL FIN		
6 n	*6.00*	
.75 i	*0.75*	
1000 CHS PV	*−1000.00*	Negative for cash paid out.
50 CHS PMT	*−50.00*	

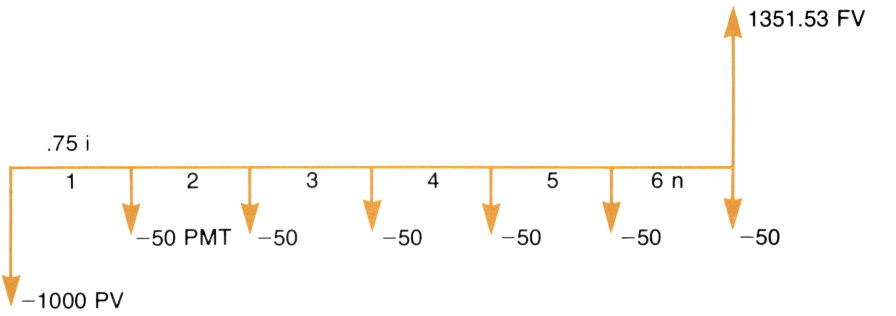


The calculator now has all of the necessary information to solve for FV, which is the last key pressed.

Press	Display	
FV	*1351.53*	The calculated value is positive indicating we receive this amount.



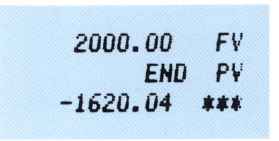
As you can see, the keys on the HP-92 and the signs of the values entered correspond precisely to the problem as represented by the cash flow diagram.



Suppose you wanted to increase your initial investment (PV) sufficiently to create an ending balance (FV) of $2000 with the same interest rate, number of periods and payments. What present value would be necessary?

There is no need to start the entire problem over again. The n, i, and PMT are unchanged and therefore do not have to be reentered. The only value that needs to be entered is the new desired FV. Enter the FV and solve for PV.

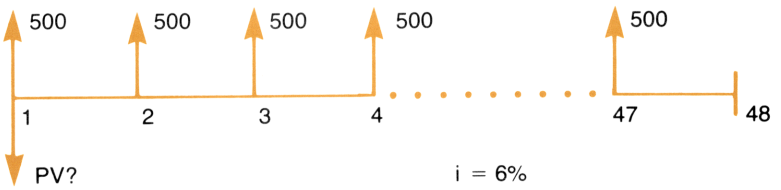
Press	Display	
2000 FV	*2000.00*	Desired cash receipt.
PV	*-1620.04*	Necessary cash paid out.



Looking over our example we find that with only a few easy keystrokes we have solved problems that would have required a great deal of time had we attempted to answer them by evaluating the complex mathematical formulas involved. The HP-92's power allows you to consider numerous investment alternatives while concerning yourself only with the underlying concepts and the practicality of the values used.

Let's try another problem. Suppose you are concerned about providing for your daughter's college education 14 years from today. You expect that the cost will be about $6000 a year or about $500 a month. If you withdrew the monthly payments for 4 years from a bank account paying 6% a year, compounded monthly, how much must you deposit in the bank at the start of the college years (PV) to make the monthly payments?

A cash flow diagram of the problem would look like the following:



The periodic interest rate must correspond to the time span between payments (compounding periods), so you must divide the yearly rate (6%) by 12 in order to produce a monthly rate **i**. As you can see from the diagram, the payments of $500 a month (PMT) start with the beginning of the time span; so you should set Payment Mode switch BEGIN NOTE ▮▮▮ END BOND to BEGIN. Since we are beginning a new problem, it is best to clear out any values remaining from the previous problem by clearing the financial storage registers **CL FIN**.

Press	Display	
CL FIN		Clears financial registers.
6 **ENTER↑** 12		
÷ **i**	*0.50*	Calculate and enter interest rate per period.
4 **ENTER↑** 12		
× **n**	*48.00*	Calculate and enter the number of compounding periods.
500 **PMT**	*500.00*	Amount received each period.
PV	*-21396.61*	Total deposit required.

```
                CL F
          6.00 ENT↑
         12.00   ÷
          0.50 ***
                 i
          4.00 ENT↑
         12.00   x
         48.00 ***
                 n
        500.00 PMT
         BEGIN PV
     -21396.61 ***
```

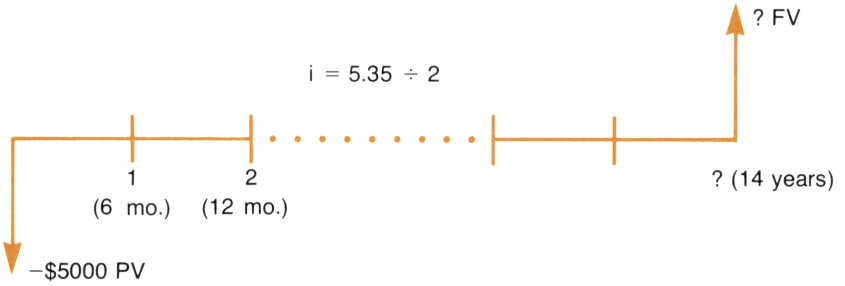
To check the contents of the financial registers press **f** LIST: FINANCE.

Press

f LIST: FINANCE

```
              LIST
         48.00   n
          0.50   i
     -21396.61  PV
          0.00  FV
        500.00 PMT
```

The next question we might ask is how do we accumulate such a sum by the time she enters college. We have several possibilities. Your daughter has a $5000 paid up insurance policy that pays 5.35% (nominal) a year compounded semi-annually. How much would it be worth by the time she enters college?

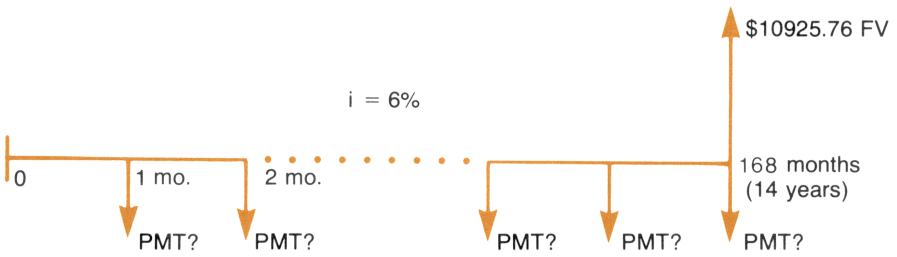


There are no payments so the Payment Mode switch BEGIN NOTE END BOND has no effect. In this problem our compounding periods occur semiannually so the yearly rate must be divided in half to obtain **i**. The value of **n** is 14 years times 2 periods per year. This is another new problem, so be sure to clear the financial registers.

Press	Display	
CL FIN		
14 ENTER↑ 2		
× n	*28.00*	Total number of periods.
5.35 ENTER↑ 2		
÷ i	*2.68*	Periodic interest rate.
5000 CHS PV	*−5000.00*	Deposited (a negative value).
FV	*10470.85*	Value of policy.

```
                CL F
          14.00 ENT↑
           2.00   x
          28.00 ***
                 n
           5.35 ENT↑
           2.00   ÷
           2.68 ***
                 i
       -5000.00  PV
          BEGIN  FV
       10470.85 ***
```

The insurance policy will supply about half of the needed amount. An additional amount must be set aside to make up the $10925.76 deficit (21396.61 − 10470.85). Beginning next month, if we made monthly payments into a special college account, how large would the payments have to be to accumulate the necessary future value of $10925.76 in the 14 years remaining? Assume the account would pay 6% a year, compounded monthly.



Rather than multiplying 14 times 12 to get the proper number of compounding periods for n and dividing 6 by 12 for i, we can use a shortcut provided on the financial keys for making quick conversions from years and yearly rates to months and monthly rates.

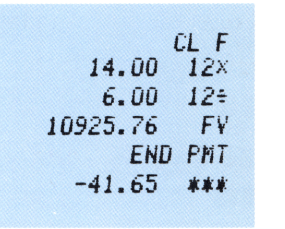
Remember: n must always be the total number of compounding periods in the time span.

i must always be the interest rate per compounding period.

If n and i do not correspond to the same period, refer to the *HP-92 Applications Book*.

Set the Payment Mode switch BEGIN NOTE ▬▬ END BOND to END.

Press	Display	
CL FIN		
14 f 12×	*168.00*	Automatically carries out the multiplication by 12 and stores the answer in n.
6 f 12÷	*0.50*	Divides by 12 and stores in i.
10925.76 FV	*10925.76*	Future value desired.
PMT	*–41.65*	Necessary deposit each period (each month).



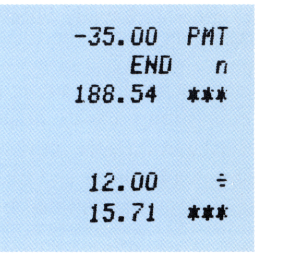
Note that we used the 12× key to automatically compute and store the value of n, and the 12÷ key to automatically compute and store the value of i.

If we made the payment only $35 a month, how long (n) would it be before we reached the desired amount?

Press	Display	
35 CHS PMT	*–35.00*	
n	*188.54*	Number of periods.

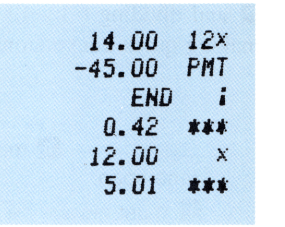
In order to find the number of years, divide by 12.

Press	Display	
12 ÷	*15.71*	Years.
or		
RCL f 12×	*15.71*	To convert n to years.



If, on the other hand, the monthly payment were increased to $45, with the 14-year term, the excess could be used as a contingency fund. For instance, with a $45 a month payment, what interest rate could the bank pay, while still enabling us to meet our goal?

Press	Display	
14 f 12×	*168.00*	Original term.
45 CHS PMT	*–45.00*	New monthly deposit.
i	*0.42*	Monthly interest rate.
12 ×	*5.01*	Nominal yearly interest rate.

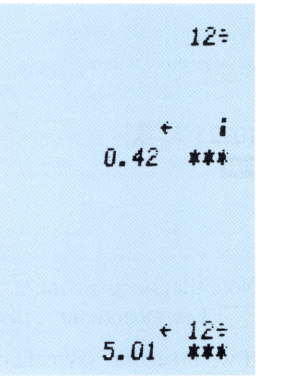


Note that it was necessary to reenter the length of the original term. Our previous computation of n (15.71) was stored in the n -register and would have otherwise been used for the term of this calculation.

We have seen how the HP-92 provides a shortcut for converting a yearly rate to a monthly rate using the f 12÷. Is there a shortcut for converting from a monthly rate to a yearly rate? The answer is yes. In order to demonstrate, let's go back to our monthly rate.

Try one of the following:

Press	Display	
f 12÷	*0.42*	We've done this before.
OR		
RCL i	*0.42*	Recall our previous interest rate solution from i.



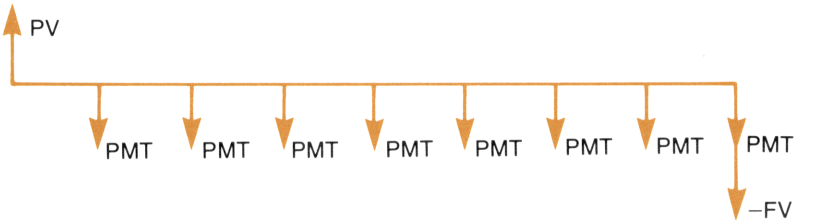
Now let's convert the monthly rate to a yearly rate.

Press	Display
RCL f 12÷	*5.01*

As you can see there is often more than one way to produce the same answer once you learn the many capabilities of your calculator. Time invested in becoming familiar and comfortable with your HP-92 will result in increased computational ability, enjoyment, and satisfaction.

In the preceding sample problems, we have seen how cash flow diagrams can be useful in representing a wide range of compound financial problems, and how the diagrams can be translated directly into solutions on the HP-92. The diagrams are helpful tools that describe complex business and financial problems in a manner suitable for calculation. In addition, the cash flow diagram can be applied in other ways to become a valuable aid.

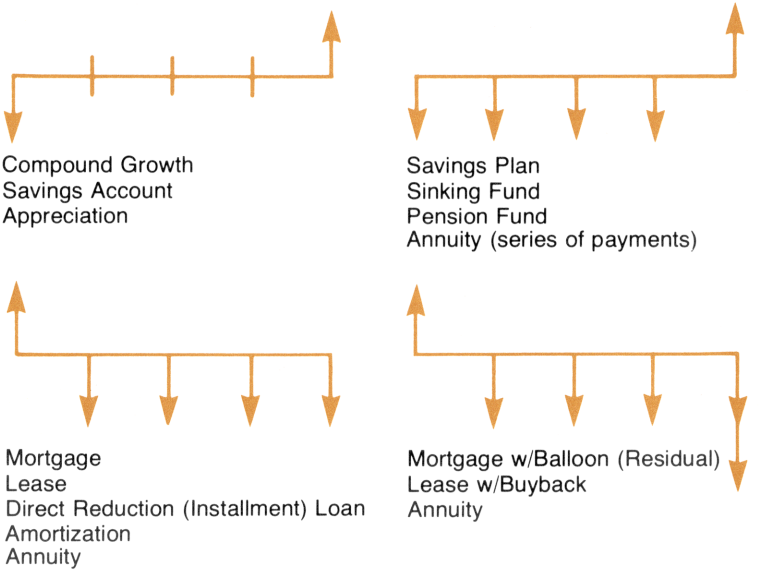
As we are all too often aware, each segment of the business community has its own special vocabulary. When considering compound interest problems of the kind we have been discussing, there are often numerous terms used throughout the business world describing the same problem, but which are not familiar outside a particular segment. For instance, this diagram:



might represent a mortgage with a balloon payment in the terminology of the banking and real estate industries or a lease with a buy back (residual) in the leasing industry. There are probably many other terms in other industries as well as countries for describing this cash transaction. But regardless of the language the essential problem is the same. In providing a means of describing business financial problems without using terminology specific to a particular segment, the cash flow diagram becomes, in a sense, a universal language.

The cash flow diagrams for four basic compound financial problems are presented in table 1 along with some of the more common terminology.

Some of the terms you see listed in the table may be common to your industry and some may not. There also may be diagrams represented that correspond to familiar transactions, but which do not bear familiar names. The important point to remember is that for compound financial calculations, it is the **magnitude** and **timing** of the cash exchanges, represented by the cash flow diagram that are important, not the industry dependent terminology.



Generalized Net Cash Flow Diagrams and Terminology
(Note that diagrams involving payments may be represented with payments at the beginning or end of the period.)

Table 1

Discounted Cash Flow Analysis

The cash flow diagrams in table 1 contain even (equal) cash flows. Discounted cash flow analysis is a way of evaluating investments with uneven cash flows. Two forms of discounted cash flow analysis are the net present value (NPV) approach and the internal rate of return (IRR) approach. Both of these functions, NPV and IRR, are preprogrammed in your HP-92 for up to 30 cash flows.

Net Present Value (NPV)

Assuming an interest rate, the net present value method finds the present value of the future cash flows and adds it to an initial cash flow.

With the HP-92, you can solve directly for the net present value of up to 30 positive and negative cash flows.

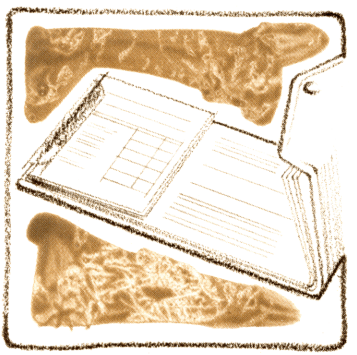
The following keystrokes are used to find the net present value of an investment. The position of the payment switch is irrelevant to this calculation.

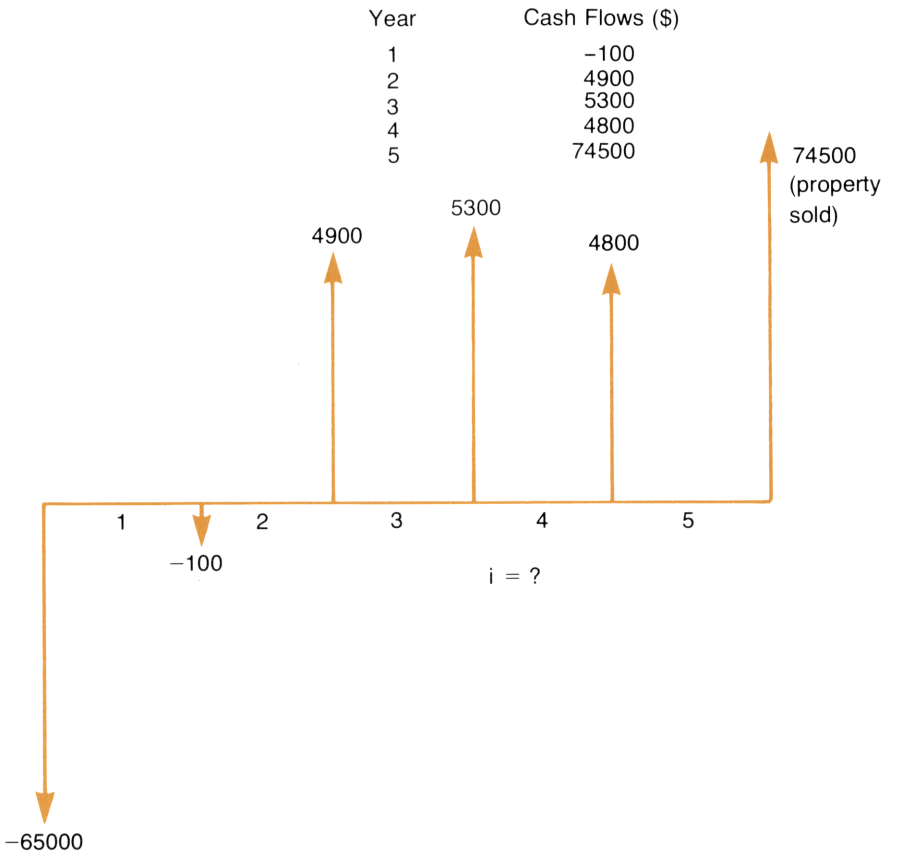
1. Press f CLEAR.
2. Key in the given interest rate, and press i.
3. Key in the number of cash flows (up to 30, excluding the initial cash flow), and press n.
4. Key in the initial cash flow, and press STO 0. If there is no initial cash flow, this step may be omitted.

   Use the cash flow sign convention; positive values for cash received and negative values for cash paid out.

5. Key in the first cash flow and press STO 1. Key in the second cash flow and press STO 2. Continue for all successive cash flows, storing them in registers R_3 through R_9, R_0 through R_9, and R_{Σ_0} through R_{Σ_9}. If n equals *30*, the last cash flow is stored in FV.
6. Press f NPV to obtain the net present value.

Example: An investor pays $65,000 for a duplex that he intends to keep 5 years and then sell. The first year he knows he will have to spend a considerable amount for repairs. Will he achieve a desired 9% after-tax yield with the following after-tax cash flows? Note that the duplex is sold for $74,500 during the fifth year.





Press	Display	
f CLEAR	*0.00*	Clear financial and storage registers.
9 i	*9.00*	Desired yield.
5 n	*5.00*	Number of cash flows.
65000 CHS		
STO 0	*−65000.00*	Initial investment.
100 CHS STO 1	*−100.00*	First cash flow.
4900 STO 2	*4900.00*	Second cash flow.
5300 STO 3	*5300.00*	Third cash flow.
4800 STO 4	*4800.00*	Fourth cash flow.
74500 STO 5	*74500.00*	Fifth cash flow.
f NPV	*−5054.61*	Net present value.

```
                CLEAR
         9.00      i
         5.00      n
-65000.00 → 0
  -100.00 → 1
 4900.00 → 2
 5300.00 → 3
 4800.00 → 4
74500.00 → 5
                NPV
-5054.61    ***
```

Since NPV is negative, the investment does not achieve the desired 9% yield.

Internal Rate of Return (IRR)

Internal Rate of Return (IRR) is the interest rate that equates the present value of all cash flows with an initial cash flow. IRR is also called the yield or discounted rate of return.

On your HP-92, the [IRR] function solves for the internal rate of return for a maximum of 30 uneven cash flows (excluding the initial cash flow). The cash flow sequence may contain only *one* sign change. That is, if the first several cash flows are negative, they should be followed by positive values only—you should not mix positive and negative cash flows interchangeably. Cash flows with multiple sign changes may have multiple answers. (The HP-92 will always find an IRR answer if one exists; however, IRR calculations with multiple sign changes may produce answers leading to erronous conclusions.) (Refer to Modified IRR-Varying Reinvestment Rate in the *HP-92 Applications Book* for problems concerning more than one negative cash flow.)

The keystroke procedure for solving [IRR] is as follows:

1. Press [f] [CLEAR].
2. Key in the number of cash flows (up to 30, excluding the initial cash flow), and press [n].
3. Key in the initial cash flow, and press [STO] [0]. The initial investment cannot be 0 (see appendix B).

   Use the cash flow sign convention: positive values for cash received and negative values for cash paid out.

4. Key in the first cash flow and press [STO] [1]. Key in the second cash flow and press [STO] [2]. Continue for all successive cash flows, storing them in registers R_3 through R_9, $R._0$ through $R._9$ and R_{Σ_0} through R_{Σ_9}. The 30th cash flow should be entered in FV.
5. Press [f] [IRR] to calculate the periodic internal rate of return. The result is stored in the [i] register.

If your problem contains some cash flows equal to zero, there is a helpful shortcut. Pressing [f] [CLEAR] at the beginning of the calculation sets the storage registers to zero, so you don't need to key those in. Simply store the non-zero cash flows in the registers that correspond to the appropriate time periods.

Also, if the problem contains consecutive cash flows that are the same, you need not key in each cash flow. Just store the first cash flow into the proper storage register, then press STO and the storage register identified for every consecutive cash flow that is the same as the first.

Example: What is the estimated rate of return Marcy Winder would get on her famous Chili Bowl Restaurant that cost $200,000? Following is a summary of 25 months of cash flows for Marcy's restaurant. Note that the restaurant is sold in the 25th month.

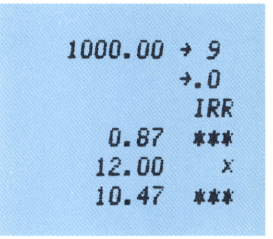
End of Month	Cash Flow	End of Month	Cash Flow
1	−1000	14	1000
2	−1000	15	1200
3	−750	16	1200
4	−500	17	1400
5	−100	18	1400
6	−100	19	1400
7	−100	20	1400
8	−100	21	1800
9	0	22	1800
10	0	23	1800
11	1000	24	2100
12	1000	25	230,000
13	1000		

Press	Display
f CLEAR	*0.00*
25 n 200000	
CHS STO 0	*−200000.00*
1000 CHS STO	
1 STO 2	*−1000.00*
750 CHS STO 3	*−750.00*
500 CHS STO 4	*−500.00*
100 CHS STO 5	
STO 6 STO 7	*−100.00*
STO 8 1000	
STO • 1 STO	
• 2	*1000.00*
STO • 3 STO	
• 4 1200 STO	
• 5	*1200.00*
STO • 6 1400	
STO • 7	
STO • 8	*1400.00*
STO • 9 STO	
Σ+ 0 1800	
STO Σ+ 1	*1800.00*
STO Σ+ 2 STO	
Σ+ 3 2100	
STO Σ+ 4	*2100.00*
230000 STO	
Σ+ 5	*230000.00*
f IRR	*0.83*
12 ×	*10.02*

```
                CLEAR
        25.00     n
-200000.00 → 0
 -1000.00 → 1
             → 2
  -750.00 → 3
  -500.00 → 4
  -100.00 → 5
             → 6
             → 7
             → 8
  1000.00 →.1
             →.2
             →.3
             →.4
  1200.00 →.5
             →.6
  1400.00 →.7
             →.8
             →.9
             →Σ0
  1800.00 →Σ1
             →Σ2
             →Σ3
  2100.00 →Σ4
230000.00 →Σ5
              IRR
     0.83   ***
    12.00     x
    10.02   ***
```

Your versatile HP-92 also lets you change cash flow values without having to restart an NPV or IRR problem. You can even change the number of cash flows included in the IRR problem by changing the number in the n register. For example, if Marcy had been able to keep a good chili cook during months 9 and 10, and made a $1000 profit each month, how would that affect her rate of return? (You overwrite registers R_9 and $R._0$ with new values.)

Press	Display
1000 STO 9	
STO • 0	*1000.00*
f IRR	*0.87*
12 ×	*10.47*



It should be noted that IRR does not consider outside factors such as the source and use of the represented cash flows. Other methods for calculating a yield can be found in the *HP-92 Applications Book*.

Section 4

Amortization and Depreciation Schedules

Amortization Schedule

You can use your HP-92 to generate an amortization schedule for a fully amortized loan from any beginning period to any ending period. All you need to do is key in the principal, periodic interest rate, periodic payment, and beginning and ending periods.

There is no need to set the Payment Mode switch. Your HP-92 automatically assumes this to be a compound interest problem. Also, it is not necessary to observe positive and negative cash flows when generating an amortization schedule. Simply key in all values as positive. In order to see all of the values calculated for the amortization schedule, you should set the Print Mode switch MAN ALL NORM to ALL.

For each period, the HP-92 prints the payment number, the interest portion of the payment, the principal portion of the payment, and the remaining balance of the loan. Upon completing the schedule, the HP-92 prints the sum of all principal and interest payments in the schedule, and the remaining balance.

1. Press CL FIN.
2. Set the Print Mode switch MAN ALL NORM to ALL.
3. Input the following in any order:
   - Key in the periodic interest rate, and press i.
   - Key in the payment amount, and press PMT.
   - Key in the initial principal, and press PV.
4. Key in the number of the beginning payment in the desired time frame, and press f P1.
5. Key in the number of the last payment in the time frame, and press g P2.
6. Press AMORT.

In amortization, all calculated values are rounded to match the display setting. The normal display shows numbers as dollars and cents. If your problem requires other rounding, set the display to the number of digits you wish carried. For example, if you wish values rounded to four places after the decimal point, press g 4 before beginning the problem. This rounding scheme does not effect the n, i, or FV keys.

Example: Generate an amortization schedule for the first 3 months of a $50,000 mortage at 8¾% annual interest with monthly payments of $394. Set the Print Mode switch MAN ALL NORM to ALL to get a complete printed copy of the problem.

Press	Display	
		CL F
	50000.00	PV
	394.00	PMT
	8.75	12÷
	1.00	P1
	3.00	P2
		AMRT
	1.00	P
CL FIN		INT
g 2		PRN
50000 PV	50000.00	BAL
394 PMT	394.00	
8.75 f 12÷	0.73	2.00 P
1 f P1	1.00	364.37 INT
3 g P2	3.00	29.63 PRN
AMORT	49911.10 ← Remaining balance.	49940.95 BAL
	Period. →	3.00 P
	Interest amount. →	364.15 INT
	Principal amount. →	29.85 PRN
	Remaining balance. →	49911.10 BAL
	Accrued principal. →	88.90 ΣPRN
	Accrued interest. →	1093.10 ΣINT
	Remaining balance. →	49911.10 ***

The accrued principal and interest, and the remaining balance can be reviewed without using the printer by displaying the contents of the individual stack registers using R↓ or R↑ —(see Manipulating Stack Contents, page 86).

The remaining schedule balance is already displayed (the X-register). The sum of the interest payments are stored in the Y-register, and the sum of the principal payments are stored in the Z-register.

Press	Display	
	49911.10	Remaining balance already displayed (X-register).
R↓	1093.10	Sum of interest payments (Y-register).
R↓	88.90	Sum of principal payments (Z-register).

	R↓
1093.10	***
	R↓
88.90	***

For additional information on the stack registers, see Manipulating the Stack Contents (page 86).

Accumulated Interest and Remaining Balance

If you wish only to calculate the accumulated interest and remaining balance on a loan at any point in time or between two points in time (the HP-92 assumes that payments are made at the end of the period. The position of the Payment Mode switch BEGIN / NOTE — END / BOND is ignored):

1. Set the Print Mode switch MAN — ALL — NORM to MAN, ALL or NORM. Your printer tapes will match the following example if you set the Print Mode switch to NORM.
2. Follow the keystrokes given for amortization schedule.
3. After the calculator stops, press PRINT x to print the remaining balance.

Example: Suppose you decide to sell your house after owning it for 4 years, 7 months. If you have a 9¼%, $35,000 mortgage and you've made monthly payments of $287.94, what is the remaining balance of your mortgage? Set the Print Mode switch to NORM.

Press	Display
CL FIN	
9.25 f 12÷	*0.77*
35000 PV	*35000.00*
287.94 PMT	*287.94*
1 f P1	*1.00*
4 ENTER↑ 12 × 7 +	*55.00*
g P2	*55.00*
AMORT	*33762.75*
PRINT x	

```
                CL F
             9.25 12÷
         35000.00 PV
           287.94 PMT
             1.00 P1
             4.00 ENT↑
            12.00 x
             7.00 +
                P2
             AMRT
          1237.25 ΣPRN
         14599.45 ΣINT
         33762.75 ***
```

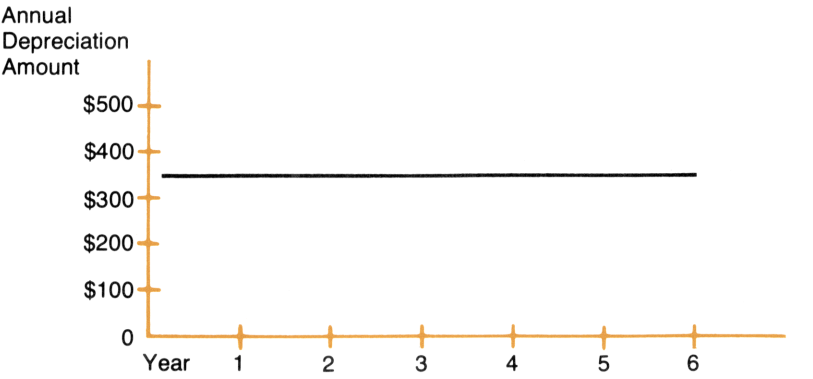
Depreciation Schedule

There are three methods of depreciation commonly used: straight-line, sum-of-the-years'-digits, and declining-balance. Refer to the *HP-92 Applications Book* for a discussion of depreciation schedules. Let's take a popcorn machine that costs $2500 brand new and has a salvage value of $400. We will depreciate the $2100 over a life expectancy of 6 years, using each of these three methods. (Be sure to check IRS regulations if you are using your HP-92 for tax purposes.)

Straight-Line Method

The straight-line method (SL) is simply a matter of dividing the total depreciable amount by the number of useful years, then subtracting that amount each year from the item's value. The depreciation on the popcorn machine is $2100, divided by 6 years = $350 a year.

If you plot this depreciation amount on a graph, it looks like a straight line; hence, the name.



Straight-Line Depreciation

The advantage of the straight-line method is its simplicity—it's easy to figure and it's consistent. Your deduction is always the same.

In reality, some items depreciate the most during their initial periods of use. For example, the value of your car declines the most in the first two years. Or perhaps your equipment wears out most in the later years, but you want to increase the initial depreciation for the financial advantages. This is called accelerated depreciation, and you would use one of the following two methods.

Sum-of-the-Years'-Digits Method

The sum-of-the-years'-digits method (SOYD) is based on the sum of the digits from one year to the number of years of the asset's life. For the popcorn machine, the life is 6 years, so:

$$6 + 5 + 4 + 3 + 2 + 1 = 21 \text{ (sum of the years digits)}$$

Theoretically, the first year you use up 6/21 of the asset's life; the second year, 5/21 of the asset's life, etc. So, the first year, you multiply the depreciable value ($2100) by that year's use (6/21).

$$\frac{6}{21} \times \$2100 = \$600$$

The second year, by that year's use:

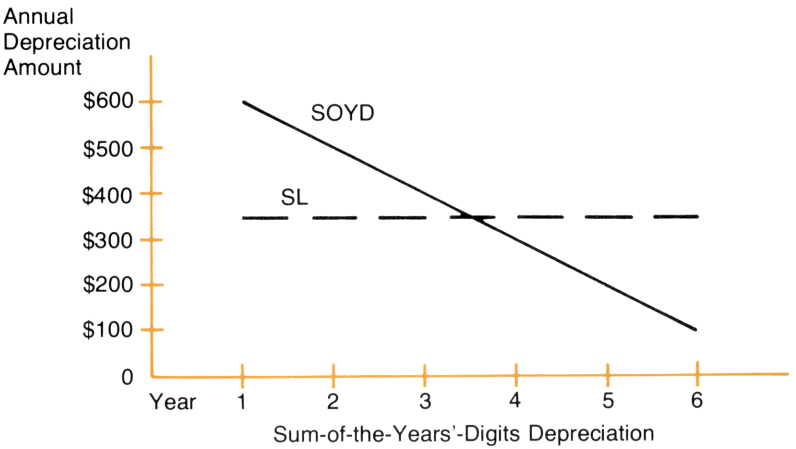
$$\frac{5}{21} \times \$2100 = \$500$$

The third year:

$$\frac{4}{21} \times \$2100 = \$400$$

Etc.

If you plot the depreciation on a graph, you can see the difference between the straight-line method and the sum-of-the-years'-digits method.



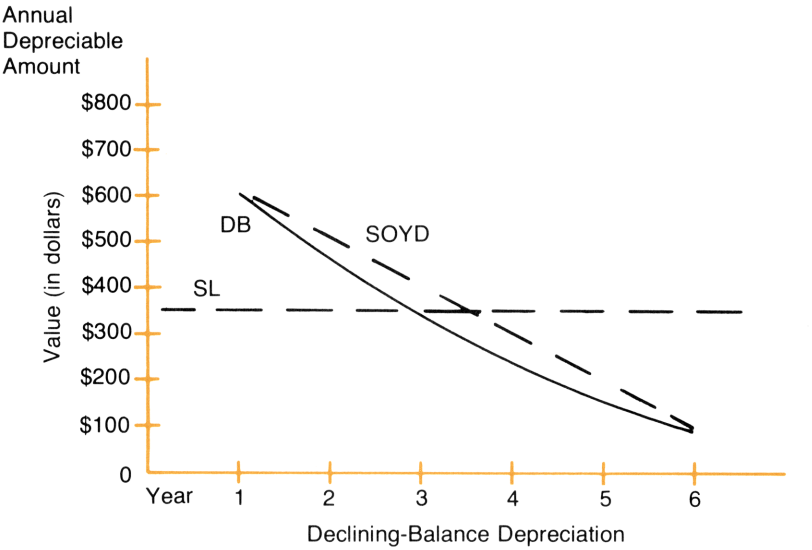
Declining-Balance Method

With the declining-balance method (sometimes called the fixed-rate method), a constant percentage is applied each year to the remaining balance (book value) to find the depreciable amount. The salvage value is not subtracted initially, but the asset may not be depreciated below this salvage value.

Certain declining balance "factors" are authorized for income tax purposes. A factor of 125% simply means 125% declining balance, 200% means double-declining balance. To compute the annual depreciation rate, divide the factor by the asset's estimated life in years. If you use a a factor of 150% for the popcorn machine, then you will depreciate it $\frac{150\%}{6}$ or 25% each year. (Make sure to consult the IRS regulations concerning declining-balance factors.)

	Depreciation	Balance (Book Value)
1st year 25% of $2500 =	$625.00	$1875.00
2nd year 25% of $1875 =	$468.75	$1406.25
3rd year 25% of $1406.25 =	$351.56	$1054.69
4th year 25% of $1054.69 =	$263.67	$ 791.02
5th year 25% of $791.02 =	$197.75	$ 593.26
6th year $593.26 − $400 (salvage value) =	$ 93.26	$ 400.00

You can plot the declining balance depreciation on the graph to compare it with the other two methods.



Declining-Balance Depreciation

On your HP-92, the three keys labeled SL, SOYD, and DB correspond to the three methods of computing depreciation. You can calculate a complete depreciation schedule for the entire life of an asset or calculate the depreciation allowance for a specific period, such as the second year.

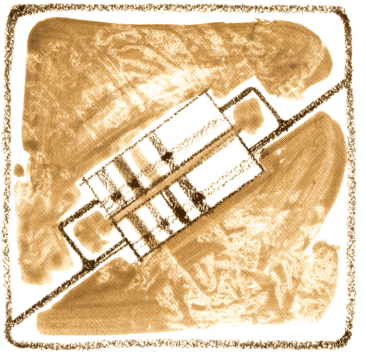
All entries should be positive values. The positive and negative cash flow signs do not apply to depreciation problems. Also, the positions of the Payment Mode switch and the Day Basis switch are irrelevant; you can ignore both switches.

To calculate any of the three kinds of depreciation schedules on your HP-92:

1. Set the Print Mode switch MAN ALL NORM to ALL.
2. Press CL FIN to clear any previous data.
3. Key in the asset's initial cost or purchase price, and press f BOOK.
4. Key in the salvage value, and press f SAL. If there is no salvage value, skip to step 5.
5. Key in the asset's depreciable life (number of years), and press f LIFE.
6. If you are using the declining-balance method, key in the factor as a percent (e.g. 125 or 200), and press g FACT.
7. Key in the year at which you wish to schedule to begin, and press g N1.
8. Key in the year at which you wish to schedule to end, press g N2. For example, if you wish to generate a depreciation schedule over the entire 6-year lifetime, press 1 g N1, 6 g N2. But if you wish to find just the first year's allowance, press 1 g N1, g N2.
9. Press the appropriate method key: SL, SOYD, or DB.

The HP-92 prints the period, the depreciation amount for that period, and the remaining depreciable value of the asset. Remaining depreciable value is defined as book value minus (−) salvage value.

Example 1: A computer system, purchased for $118,000, is depreciated over 5 years using the SOYD method. The estimated salvage value is $10,000. Generate a depreciation schedule for this piece of equipment. Set the printer mode switch ALL MAN NORM to ALL. Note that if you don't wish to print the entire schedule you can set the Print Mode switch to MAN or NORM and view the remaining depreciable value (X-register) and accumulated depreciation (Y-register) using the R↓ or R↑ keys (see Manipulating Stack Contents, page 86).



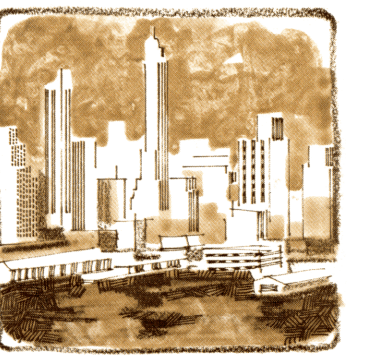
Press	Display	
		CL F 118000.00 BOOK 10000.00 SAL 5.00 LIFE 1.00 N1 5.00 N2 SOYD 1.00 N 36000.00 DPN 72000.00 RDV
CL FIN		
118000 f BOOK	*118000.00*	Book value.
10000 f SAL	*10000.00*	Salvage value.
5 f LIFE	*5.00*	Life of asset.
1 g N1	*1.00*	First period of schedule.
5 g N2	*5.00*	Last period of schedule.
SOYD	*0.00*	Remaining depreciable value (X-register).
		Use R↓ or R↑ to view Y-register (accumulated depreciation).
		2.00 N 28800.00 DPN 43200.00 RDV 3.00 N 21600.00 DPN 21600.00 RDV 4.00 N 14400.00 DPN 7200.00 RDV 5.00 N 7200.00 DPN 0.00 RDV
		Accumulated depreciation → 108000.00 ΣDPN 0.00 ***

How does this compare with straight-line depreciation? Your HP-92 already contains all the necessary values, so just press SL to see the alternative.

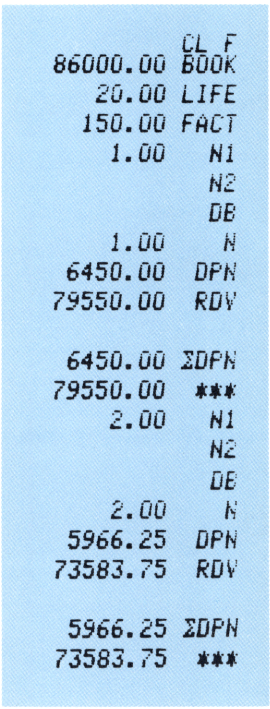
Press	Display	
SL	*0.00*	Remaining depreciable value (X-register). Use R↓ or R↑ to view Y-register (accumulated depreciation).

```
                SL
          1.00   N
      21600.00 DPN
      86400.00 RDV

          2.00   N
      21600.00 DPN
      64800.00 RDV

          3.00   N
      21600.00 DPN
      43200.00 RDV

          4.00   N
      21600.00 DPN
      21600.00 RDV

          5.00   N
      21600.00 DPN
          0.00 RDV

     108000.00 ΣDPN
          0.00 ***
```

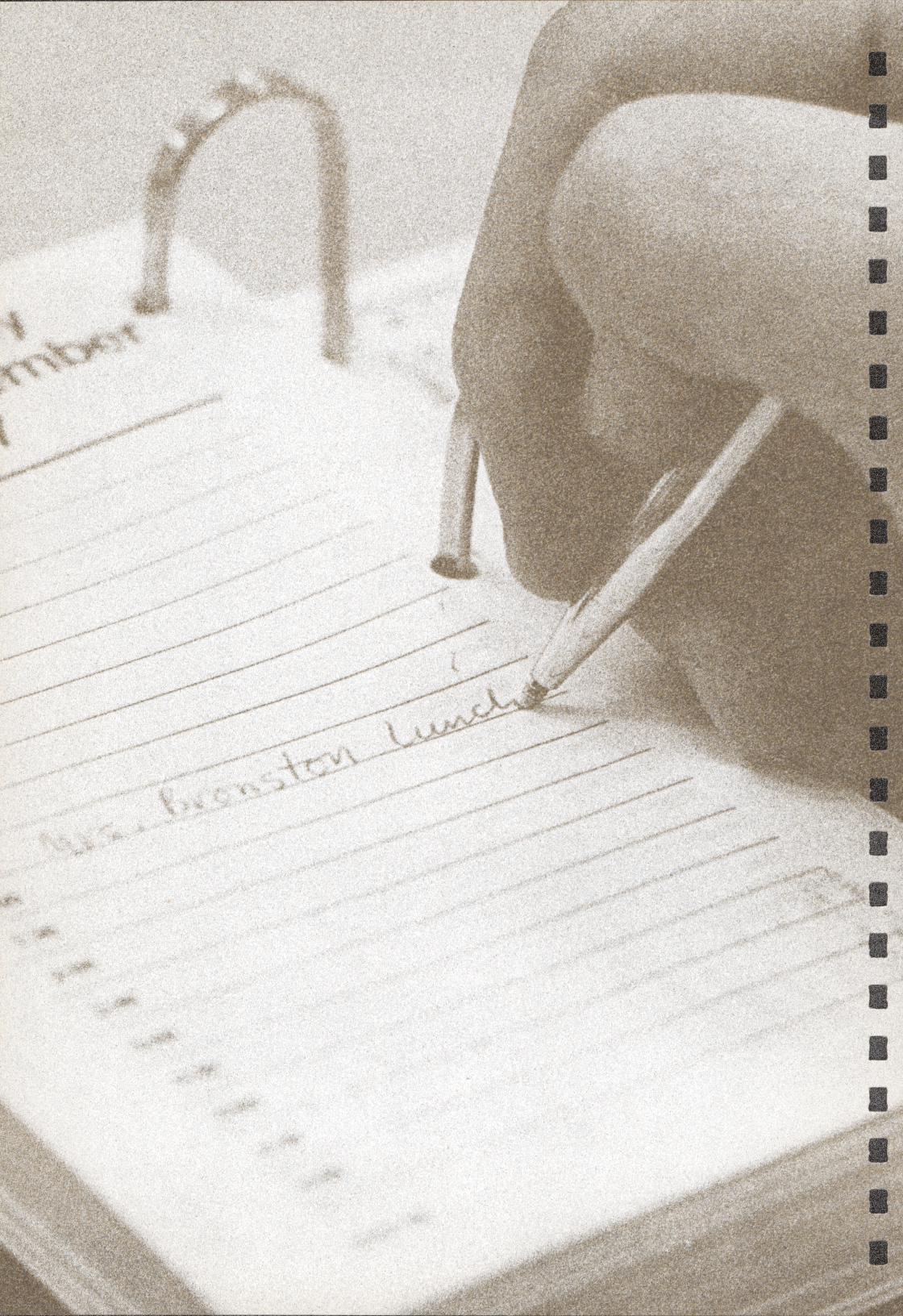
Example 2: The Drifter Apartments have a depreciable value of $86,000. The owner wishes to use 150% declining balance depreciation over 20 years. What is the annual depreciation allowance and remaining depreciable value in years 1 and 2?



Press	Display	
CL FIN		
86000 f BOOK	*86000.00*	Depreciable value.
20 f LIFE	*20.00*	Depreciation period.
150 g FACT	*150.00*	Declining balance factor.
1 g N1 g N2	*1.00*	First period.
DB	*79550.00*	Remaining depreciable value.
2 g N1 g N2	*2.00*	Second period.
DB	*73583.75*	Remaining depreciable value.



Note that any amortization or depreciation schedule calculation may be terminated by pressing any key.



Section 5

Percentage and Calendar Keys

Calculating Percentage Problems

There are three keys on your HP-92 for calculating percentage problems. The [%] function is used to find a percentage of a number. The [Δ%] function is used to find percent differences (% increase/decrease). And the [%Σ] function is used to find what percent one number is of another or of the total sum (proportion).

With the HP-92, you don't have to convert percents to their decimal equivalents; 4% need not be changed to .04, so it can be keyed in the way you see and say it, 4 [%].

Set the Print Mode switch ALL MAN NORM to MAN.

Percentage [%]

To find the percentage of a number, key in that base number and press [ENTER↑]. Then key in the numerical value of the percent and press [%].

For example, find 14% of $300:

Press	Display
300 [ENTER↑]	*300.00*
14 [%]	*42.00*

Example: Every year you set aside 4% of your company's profits for the employee retirement fund. If your company made a profit last year of $1,576,432, how much money was contributed to the fund?

Press	Display
1576432 [ENTER↑]	*1576432.00*
4 [%]	*63057.28*

Net Amount [%] [+] or [%] [−]

If you buy a new car, you have to figure the sales tax percentage, then add that to the purchase price to find the total cost of the car. It is easy to calculate this net amount with your HP-92 because the calculator holds the base number while you calculate percentages.

For example, if the sales tax on a $6200 car is 5%, what is the amount of the tax and total cost of the car?

Press	Display	
6200 ENTER↑	6200.00	
5 %	310.00	Percentage amount (sales tax).
+	6510.00	Net amount (base plus percentage amount).

If the dealer gives you a 10% discount (before taxes) on the car, what will your total cost be?

Press	Display	
6200 ENTER↑	6200.00	
10 %	620.00	Amount of discount.
−	5580.00	Discounted price.
5 % +	5859.00	Net amount (discounted price plus sales tax).

Notice in the last problem that you subtracted a percentage amount and added a percentage amount, without repeating the base number.

Percent Difference Between Two Numbers f Δ%

To find the percent difference between two numbers—the ratio of increase or decrease—key in the base number, press ENTER↑, then key in the second number and press f Δ%. Usually, the base amount, or the first number you key in, is the one that occurred first in time.

For example, your rent jumps from $285 a month to $335 a month. What percent is the increase?

Press	Display	
285 ENTER↑	285.00	
335 f Δ%	17.54	% increase.

A positive answer denotes an increase, while a negative answer denotes a decrease.

Example: You forgot to place a stop order, and your stock fell from $57.50 to $13.25 a share. What percent is the decrease?

Press	Display	
57.50 ENTER↑	57.50	
13.25 f Δ%	−76.96	% decrease.

Markup

Markup is a simple percentage calculation using the [Δ%] function and wholesale or original purchase cost as the base number.

Example: You purchase typewriters at $159.95 wholesale and retail them for $195.00. What percent is your markup?

Press	Display	
159.95	*159.95*	
195.00 [f] [Δ%]	*21.91*	% markup.

Margin

Margin also is a simple percentage problem with the [Δ%] function, only this time you use the selling price as the base number. Returning to the typewriters that you bought for $159.95 and sold for $195, the margin is calculated as follows:

Press	Display	
195 [ENTER↑]	*195.00*	
159.95 [f] [Δ%]	*–17.97*	
[CHS]	*17.97*	% margin.

So, the markup is 21.91% and the margin is 17.97%.

Percent of Total [%Σ]

[Σ] is the Greek symbol "sigma" which we use to mean sum or total. To find what percentage one number is of the total, add the numbers first by keying in each number followed by [Σ+] (summation). Then key in the particular number you wish to convert to a percentage and press [%Σ].

Example 1: Using the 17.97% margin from the previous example, determine the selling price of two other typewriters costing $220.00 and $160.95. Press [f] [CLΣ] to clear the statistical registers (more about these later).

Press	Display	
[f] [CLΣ]	*17.97*	From previous example.
100 [x≷y]	*17.97*	
[−]	*82.03*	Ratio of cost to selling price.
[Σ+]	*1.00*	Summation entry.
220 [%Σ]	*268.19*	Selling price.
160.95 [%Σ]	*196.21*	Selling price.

Example 2: You own 150 shares of stock in Coakley Laboratories, 52 shares of Idylwild Aircraft, and 200 shares of Burrell Industries. What percent of your portfolio does each represent?

Press	Display	
f CLΣ	*196.21*	From previous example.
150 Σ+	*1.00*	First entry.
52 Σ+	*2.00*	Second entry.
200 Σ+	*3.00*	Third entry.
150 %Σ	*37.31*	% Coakley Laboratories.
52 %Σ	*12.94*	% Idylwild Aircraft.
200 %Σ	*49.75*	% Burrell Industries.

The Σ+ key displays the number of entries rather than the numerical value keyed in. When you use the Σ+ key, press f CLΣ *(Clear Σ)* between problems. The Σ+ key is covered in detail in section seven.

Example 3: Assume that your Coakley Laboratories stock is worth $450; Idylwild Aircraft $1404; and Burrell Industries $1500. What percent of the total value of your portfolio does each represent?

Press	Display	
f CLΣ	*44.75*	From previous example.
450 Σ+	*1.00*	
1404 Σ+	*2.00*	
1500 Σ+	*3.00*	Number of entries.
450 %Σ	*13.42*	% Coakley Laboratories.
1404 %Σ	*41.86*	% Idylwild Aircraft.
1500 %Σ	*44.72*	% Burrell Industries.

These three stock values could be stored in the addressable storage registers rather than reentered each time. (More about storage registers later).

Proportions %Σ

To find what percent one number is of another (proportion), state the problem as "A is what percent of B?" Key in B (the base number), press Σ+, then key in A (the number to be converted), and press %Σ.

For example, 64 is what percent of 340?

Press	Display	
f CLΣ	*44.72*	From previous example.
340 Σ+	*1.00*	
64 %Σ	*18.82*	Percent.

Example: To purchase that $47,000 lakefront cabin that you've had your eye on, a $9400 down payment is required. What percentage of the price does your down payment represent?

Press	Display	
f CLΣ	*18.82*	From previous example.
47000 Σ+	*1.00*	
9400 %Σ	*20.00*	Percent.

Calendar

In many financial calculations there is a frequent need to find the number of days between two calendar dates, or the calendar date of a certain number of days in the future (or past). These calculations can be accomplished on the HP-92 utilizing the f DATE+DAYS and f △DAYS keys. The day count can be based either on a 30-day month, 360-day year or an actual day month, 365 day year, depending on the position of the Day Basis switch (see Financial Switches).

In order to use the calendar functions dates must be in the following format.

1. Key in the number of the month, and press ⊡.
2. Key in the date as a two digit number followed by the full year.

Example: June 3, 1977 is entered as 6.031977.

Days Between Dates

To calculate the number of days between two dates*, use the following procedure:

1. Key in the first date, and press ENTER↑ .
2. Key in the second date, and press f △DAYS .

With the Day Basis switch in the *365-day* position, the following values are returned in the stack (the operational stack is covered in detail in section eight):

Y	Actual number of days not including any leap days
X	Actual number of days including leap days

With the Day Basis switch in the *360-position,* the values returned are:

Y	Days calculated on a 30-day month, 360-day year
X	Actual number of days including any leap days

* The HP-92 can calculate actual days for nearly 2500 years from October 15, 1582 through November 25, 4046.

Note that regardless of the position of the Day Basis switch, the actual number of days including leap days, is always returned to the X-register.

The contents of the X-register are always visible in the display. To view the contents of the Y-register, use x⇄y to exchange the contents of the X- and Y-registers. The automatic memory stack and methods for manipulation the contents of the registers are covered in detail in section eight.

Example: How many actual days and days not including leap days are there between September 1, 1977 and April 1, 1984?

Set the Day Basis switch to the 365-day position. 360  365

Press	Display	
9.011977 ENTER↑	*9.01*	
4.011984		
f △DAYS	*2404.00*	Days not including leap days.
x⇄y	*2402.00*	Days including leap days.

The number displayed represents the contents of the X-register. With the Day Basis switch in the 365-day position the Y-register has the answer that we wanted.

Future or Past Dates

Determining a future (or past) date that is a fixed number of days before or after a given date can be accomplished using f DATE+DAYS and the following keystrokes:

1. Set the Day Basis switch to the desired setting (if needed).
2. Key in the date, and press ENTER↑.
3. Key in the number of days, and press f DATE+DAYS. Use a negative number for a date in the past.

Example: If you purchased a 120 day option on a piece of land on July 1, 1977, what would the expiration date be? The appropriate calendar basis is actual-day month, 365-day year. In order to display the entire answer (6 decimal places), set the display to 6 decimal digit mode by pressing g 6.

Press	Display	
g 6		
7.011977 ENTER↑	*7.011977*	
120 f DATE+DAYS	*10.291977*	October 29, 1977.

Day of the Week and Special Print Format

The HP-92 will print the day of the week and date for any Gregorian date in the X-register from October 15, 1582* to November 25, 4046. The displayed X-register is not altered.

The left-justified format is:

mm-dd-yyyy wwww

where:

mm = month (1 through 12)
dd = day of month (01 through 31)
yyyy = Gregorian year (1582 through 4046)
wwww = day of week (MON, TUES, WED, THUR, FRI, SAT, SUN)

To calculate and print the date and day of the week displayed in the X-register, use the following keystrokes:

1. Key in or compute the date.
2. Press 9 PRINT X.

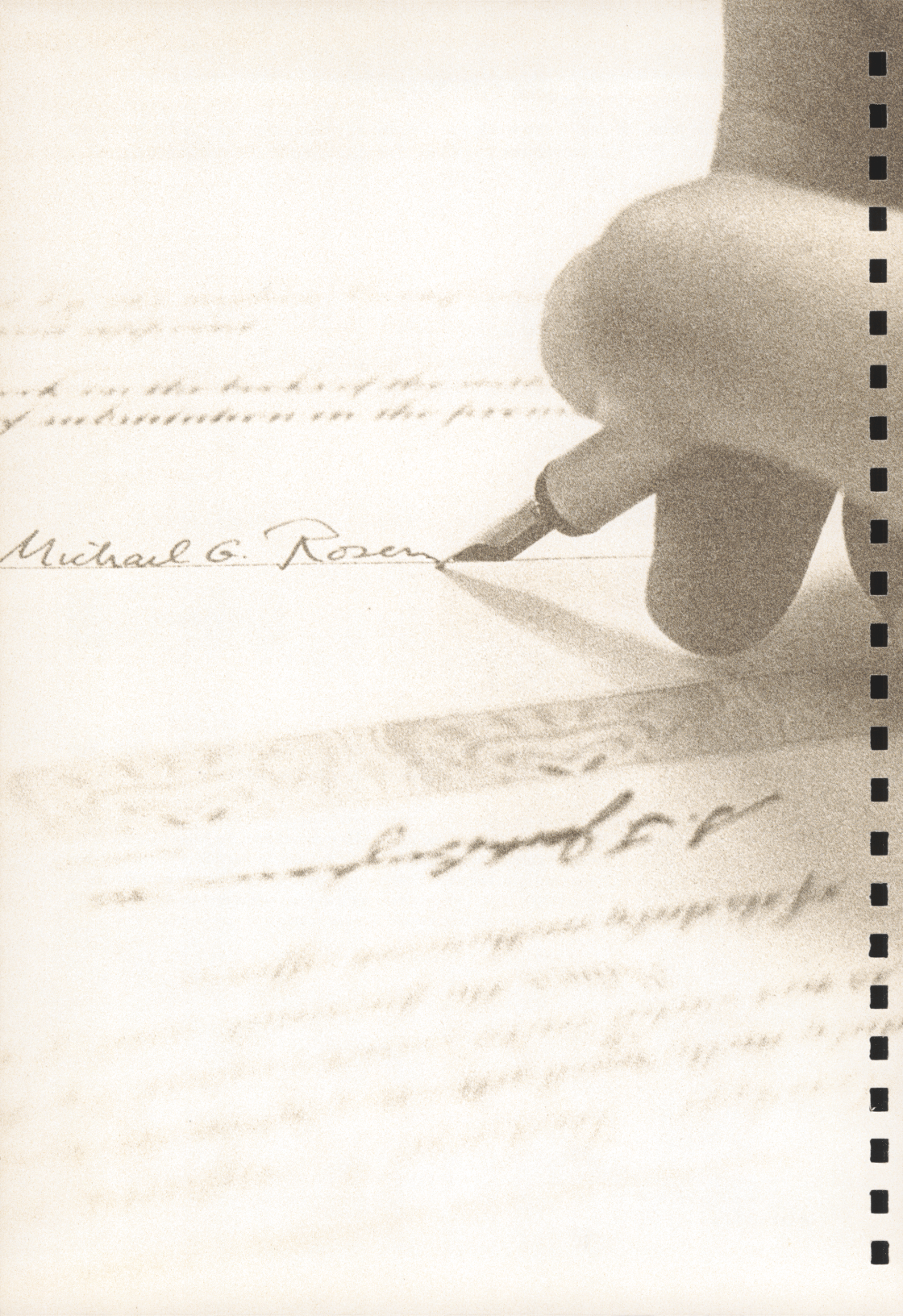
Example: On what day of the week was the great stock market crash of October 29, 1929?

Press	Display
10.291929	*10.291929*
9 PRINT X	10-29-1929 TUES

The day was the infamous Black Tuesday.

This function ignores the display format setting and position of the Print Mode switch. You may wish to use this function to label your printer tapes with the date.

* Note that early day-of-week displays may be different than those normally reported in history. The reason for this is that prior to September 14, 1752 (the day England and its colonies switched from the Julian Calendar to the current Gregorian Calendar), the Julian Calendar was standard. The Julian Calendar was falling behind by 3 days every 400 years. This problem is corrected in the Gregorian Calendar by eliminating 3 leap years every 400 years. In the Gregorian system, century years (1700, 1800, 1900, etc.) are not leap years unless they are divisable by 400 (2000, 2400, 2800, etc.) The Gregorian Calendar was adopted by other countries at various other dates.


Michael G. Rosen

Section 6

Bonds and Notes

Bond or Note?

In the securities market there are numerous interest bearing obligations: bills, notes, bonds, certificates, debentures, warrants, certificates of deposit, etc. Each of these instruments can be divided into one of three categories according to the procedure by which interest is paid to the investor. Interest is either paid semi-annually, at maturity, or as a result of discounting the purchase price.

All three categories can be calculated for yield or price (including accumulated interest) utilizing the group of keys designated BOND/NOTE.* Before beginning a problem, however, it is necessary to set the Payment Mode switch 

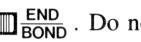
, located above the financial keyboard, to either the NOTE or the BOND position. The words BEGIN and END, which appear on the same switch, involve the financial keys (see Financial Switches) and may be ignored in this instance.

To determine the proper position for the Payment Mode switch, the following rules apply:

If the security involves semi-annual interest payments, the switch must be in the BOND position.

If the security is sold at a discount or pays interest at maturity, the switch must be in the NOTE position.

Example: Suppose you wish to calculate the price of a Federal Home Loan Bank (FHLB) note that pays interest semi-annually. What is the appropriate position for the securities switch?

Answer: The FHLB note pays interest semi-annually, so the switch must be placed in the BOND position 

. Do not be misled by the word note in the security name. On the HP-92, the words bond and note refer to the method in which interest is paid.

Bond Calculations

Using the PRICE and YIELD keys, bond problems can be solved for either variable quickly and easily. For additional ease of calculation, *the sign convention used in conjunction with the compound financial keys is not used with the bond and note group of keys.* It is also not necessary to specify a redemption value when entering values. In accordance with market convention, prices are based on a redemption (par) value of 100.

* All securities industry obligations are calculated in accordance with the Securities Industry Association's computational recommendations: Spence, Graudenz and Lynch, *Standard Securities Calculation Methods,* Securities Industries Association, New York, New York, 1973.

When solving for bond price or yield, the following steps are used. They may be executed in any order.

1. Set the Payment Mode switch to the BOND position BEGIN/NOTE ▮ END/BOND. Refer to the previous section, Bond or Note?, for a detailed explanation.
2. Set the Day Basis switch to the appropriate day base 360 ▮ 365. Refer to the HP-92 Applications Book for a more detailed explanation.
3. Key in the coupon rate as a percent and press g CPN.
4. Key in the settlement date and press f IS.ST. This key enters one date when the Payment Mode switch is in the BOND position.
5. Key in maturity (redemption) or call date, and press g MT. If you are calculating price or yield to call rather than to maturity, you must key in the call price,* and press f CALL.

When calculating bond price:

- Key in the desired bond yield as a percent and press YIELD.
- Press PRICE

The following values are calculated and returned in the X- and Y-registers of the stack:

Y	Accrued interest
X	Bond price quoted as a percent of par

There are several alternative methods for displaying the contents of the stack. For a detailed explanation, see Manipulating Stack Contents (page 86).

When calculating bond yield:

- Key in bond price as a percent of par and press PRICE.
- Press YIELD

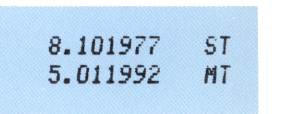
The yield, calculated in percent, is returned in the X-register and displayed.

Example: What price should you pay on August 10, 1977 for a corporate bond that matures on May 1, 1992, and pays a coupon of 6¾% if you wish a yield of 8¼%? The appropriate calendar basis is 30/360. Set the display to two decimal places (g 2) so it will match the following examples.

Set the Payment Mode switch, Day Basis switch, and Print Mode switch as follows:

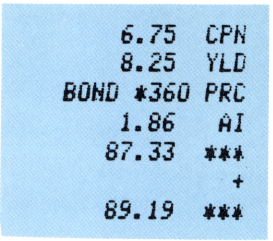
BEGIN/NOTE ▮ END/BOND 360 ▮ 365 ALL MAN ▮ NORM

Press	Display	
g 2		Set display to two decimal places.
8.101977	*8.101977*	
f IS.ST	*8.10*	August 10, 1977, settlement date.
5.011992	*5.011992*	
g MT	*5.01*	May 1, 1992, maturity date.



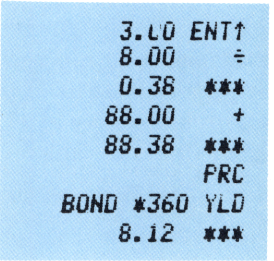
* Entering actual CALL will result in actual price; entering par CALL will result in price based on par.

6.75 g CPN	*6.75*	Coupon rate.
8.25 YIELD	*8.25*	Desired yield as a percentage.
PRICE	*87.33*	Quoted price.
+	*89.19*	Net price including accrued interest.



Suppose the market was quoting 88⅜ for the bond. What yield would that represent?

Press	Display	
3 ENTER↑	*3.00*	
8 ÷	*0.38*	The decimal equivalent
88 +	*88.38*	of 88⅜.
PRICE YIELD	*8.12*	The yield.



Notice that it was not necessary to re-enter all of the relevant values in order to solve for the yield.

Interest-at-Maturity Note Calculations

Interest-at-maturity notes can be solved for secondary trading price or for yield to maturity using the BOND/NOTE keys. When solving for either variable, the following six initial steps are used. They may be executed in any order.

1. Set the Payment Mode switch BEGIN NOTE ▮▮▮ END BOND to NOTE.
2. Set the Day Basis switch 360 ▮▮▮ 365 to the appropriate day base. Refer to page 26.
3. Key in the issue date, press ENTER↑.
4. Key in the settlement date, press f IS,ST. This key enters two dates when the Payment Mode switch is in the NOTE position.
5. Key in the maturity date, press g MT.
6. Key in the annual interest rate in percent and press g CPN.

   (Optional) If the face value of the note differs from a par of 100, you may key in the actual face value, and press f CALL.

When calculating note price:

- Key in the desired bond yield in percent and press YIELD.
- Press PRICE (stores when X-register has changed and solves when there is no change).

The values returned in the stack depend on the position of the Day Basis switch. With the switch in the *360 position* the following values are returned:

T	Accumulated interest, actual/360
Z	Price, actual/360
Y	Accumulated interest, 30/360
X	Price, 30/360

There are several alternative methods for displaying the contents of the stack. For a detailed description, see Manipulating Stack Contents (page 86).

With the Day Basis switch in the *365 position,* the following values are returned:

Y	Accumulated interest
X	Price calculated on a 365-day year

When calculating note yield:

- Key in the note price, quoted as a percent of par, and press PRICE. If the actual note face value has been entered using f CALL, enter actual price.
- Press YIELD. This key can either store or solve. It stores when the value in the X-register has changed and solves when there is no change.

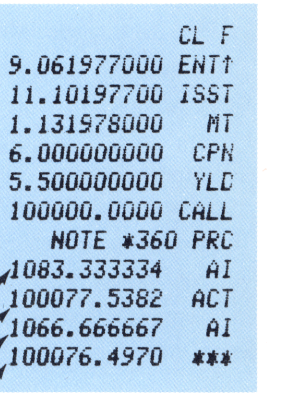
Example: Your company wishes to invest some short term funds on November 10, 1977, by purchasing a $100,000, 6% interest-bearing note that was issued on September 6, 1977 and matures on January 13, 1978. What price is acceptable in order to get a yield of 5.5%. The appropriate calendar basis is Actual/360.

Set the Day Basis switch 360 ▮ 365 to 360.

Set the Payment Mode switch BEGIN/NOTE ▮ END/BOND to NOTE.

In order to display full accuracy, set display to decimal 9 by pressing g 9.

Press	Display	
CL FIN		
9.061977		
ENTER↑	*9.061977000*	September 6, 1977, issue date.
11.101977		
f IS.ST	*11.10197700*	November 10, 1977, settlement date.
1.131978		
g MT	*1.131978000*	January 13, 1978, maturity date.
6 g CPN	*6.000000000*	Annual interest.
5.5 YIELD	*5.500000000*	Desired yield.
100000 f CALL	*100000.0000*	Face value.
PRICE	*100076.4970*	Accumulated interest, actual/360.
		Price, actual/360.
		Interest, 30/360.
		30/360 price at par.



Discounted Note Calculations

Notes paying interest as a result of discounting the purchase price can be calculated for discounted price, secondary price, or yield.

All calculations involve the same first four steps that may be executed in any order.

1. Place the Payment Mode switch BEGIN/NOTE ▮▮▮ END/BOND in the NOTE position.
2. Set the Day Basis switch 360 ▮▮▮ 365 to appropriate position.
3. Key in the issue date (when computing discounted price) or the settlement date (when computing secondary price) and press ENTER↑ followed by f [I,S,ST].
4. Key in the maturity date and press g [MT].

   (Optional) If the face value of the note differs from a par of 100, you may key in the actual face value, and press f [CALL].

When calculating the discounted price (given a discount rate):

- Key in the discount rate, and press CHS followed by g [CPN]. The rate is entered as a negative number to indicate that it is used for discounting.
- Press PRICE.

When calculating the secondary price (trading price):

- Key in the desired yield, as a percent, and press YIELD.
- Press PRICE.

The values returned in the stack depend on the position of the Day Basis switch. With the switch in the *360 position* the following values are returned:

T	Accumulated interest, actual/360
Z	Price, actual/360
Y	Accumulated interest, 30/360
X	Price, 30/360

There are several alternative methods for displaying the contents of the stack. For a detailed description, see Manipulating Stack Contents (page 86).

With the Day Basis switch in the *365 position* the following values are returned:

Y	Accumulated interest
X	Price calculated on a 365-day year

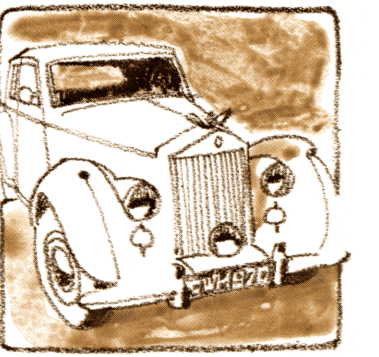
When calculating yield:

- Key in the note price either quoted as a percent of par, or face value depending on the value in [CALL], and press PRICE.
- Press YIELD.

The values returned depend on the position of the Day Basis switch 360 ▮▮▮ 365. In 365, the X-register contains the yield. In 360, the X-register contains the yield on a 30/360 basis, and the Y-register contains the yield on an actual/360 basis.

NOTE: The value in CPN must always be zero when solving for yield. If CL FIN was pressed prior to beginning the yield computation, a zero was automatically stored in CPN. However, if the discounted price was calculated prior to the yield computation, it is easier to key in zero and press g CPN. This saves re-entering the issue date, the maturity date, and the call value (if applicable).

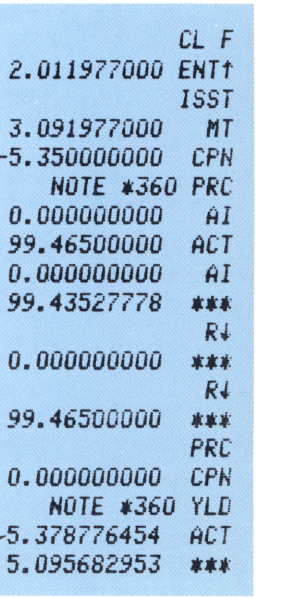
Example: What is the discounted price and effective yield on a $10,000 bill that is purchased on February 1, 1977, matures on March 9, 1977, and is discounted at 5.35%? The accepted calendar base is actual day month, 360 day year.



Set the Payment Mode switch BEGIN/NOTE ▮ END/BOND to NOTE.

Set the Day Basis switch 360 ▮ 365 to 360.

Press	Display	
CL FIN		
2.011977 ENTER↑		
f IS,ST	*2.011977000*	February 1, 1977. Issue date.
3.091977		
g MT	*3.091977000*	March 9, 1977. Maturity date.
5.35 CHS		
g CPN	*-5.350000000*	Discount rate.
PRICE	*99.43527778*	Price based on par 30/360 basis.
R↓ R↓	*99.46500000*	Price on an actual/360 basis.
PRICE	*99.46500000*	Enters actual/360 price.
0 g CPN	*0.000000000*	Clears CPN without using CL FIN.
YIELD	*5.095683000*	Yield on a 30/360 basis.
		Yield on an actual/360 basis.
g 2	*5.38*	Return to two decimal display



Section 7

Statistical and Arithmetic Functions

In addition to its built-in financial formulas, your HP-92 also contains several preprogrammed statistical and arithmetic functions. These are useful in several areas—for example, real estate appraisal, forecasting, predicting trends, and investment analysis.

Statistical Functions

The following keys are used in statistical calculations:

Σ+	Sigma plus. Accumulates x and y values, their products, and squares.
f Σ−	Sigma minus. Subtracts x and y values, their product, and squares from the accumulation in Σ+. Useful for deleting an incorrect entry.
f L.R.	Linear regression. Computes the slope and y-intercepts of a straight line that best fits a set of data points.
ŷ	Linear estimate. Given a value for x, this computes the predicted value for y.
g r	Correlation coefficient calculates a measure of the linear relationship between two variables. r = +1 (perfect fit, positive slope) r = −1 (perfect fit, negative slope) r = 0 (no fit)
f x̄	Mean. Computes the means or arithmetic averages of accumulated x and y values.
g s	Standard deviation. Calculates the dispersion around the mean of accumulated x and y values.

Before starting a new statistical problem press f CL Σ. This clears old data from the statistical registers.

Summations

Pressing the Σ+ key automatically accumulates several different sums and products of values in the X- and Y-registers. The calculator stores these values in registers R_{Σ_0} through R_{Σ_5}.

When you key in one or two numbers and press Σ+, the following happens:

1. The number of entries is stored in register R_{Σ_0}.
2. The number (x) on the display is added to the contents of storage register R_{Σ_1}.
3. The square (x^2) of the display number is added to the contents of register R_{Σ_2}.
4. The number in the Y-register of the stack is added to the contents of storage register R_{Σ_3}.
5. The square of y (y^2) is added to the contents of register R_{Σ_4}.
6. The product of x and y (xy) is added to the contents of register R_{Σ_5}.

When you input paired data (x and y), you must key in the y value first and separate the two numbers by ENTER↑. The general rule is:

y value ENTER↑ x value Σ+

To recap, this is where values are stored inside your calculator:

Register	Contents
R_{Σ_0}	Number of entries (n).
R_{Σ_1}	Summation of x values (Σx).
R_{Σ_2}	Summation of x^2 values (Σx^2).
R_{Σ_3}	Summation of y values (Σy).
R_{Σ_4}	Summation of y^2 values (Σy^2).
R_{Σ_5}	Summation of products of x and y values (Σxy).
Display (X-register)	Number of entries (n).

Immediately, you have a powerful data bank for statistical calculations. To see any of these summations at any time, simply recall the contents of the desired register. Remember, when you recall a number from a register, only a copy of the number appears in the display.

> **Note:** If your data $\{x_i\}$ or $\{y_i\}$ contains many redundant leading digits, you should refrain from copying them into the calculator. For example, if your x-data is {665999, 666000, 666001}, you should enter the x-data as {999, 1000, 1001} and add 665000 to any x-related answer produced.

Viewing the Statistical Registers

To see these summations in registers R_{Σ_0} through R_{Σ_5}, press f LIST: Σ. The data in these registers will be printed with labels, along with the data in registers R_{Σ_6} through R_{Σ_9}.

To view the contents of a specific register, simply press RCL, then the address of the desired register (R_{Σ_0} through R_{Σ_5}).

Deleting and Correcting Data

If you key an incorrect entry into Σ+, you don't have to start over again. If you keyed it before pressing Σ+, simply press CL x to clear the display, then continue on with the correct value.

If you had already added in the wrong value, simply key in that wrong number and press f Σ−, then continue with the correct number.

This applies to two variables, as well as one. Suppose you key in 10 ENTER↑ 20 Σ+ and discover that the y value is wrong. Delete the data pair by pressing 10 ENTER↑ 20 f Σ−, then continue with the correct numbers.

Mean

Your HP-92 can quickly calculate the means or arithmetic averages of one or two variables. Whether it's the average of test scores or last month's sales figures, given one or two sets of numbers, your HP-92 will calculate the mean of those samples.

1. Press f CLΣ (*Clear* Σ).
2. If your are summing *one* set of numbers, key in the first number and press Σ+; then the second number and Σ+ again; the third number, etc. Continue until you have entered all the values.
3. If you are summing *two* sets of numbers, key in the y value and press ENTER↑; key in the x value, then press Σ+. Key in the second y value, press ENTER↑, key in the second x value, and press Σ+. Continue until you have entered all the values.
4. Press f x̄ for the mean of the x values.
5. Press x≷y for the mean of the other set of values (y).

Example: A survey of seven salesmen in your company reveals that they work the following hours a week and sell the following dollar volume each month. How many hours does the average salesman work each week? How much does the average salesman sell each month?

Salesman	Hours/Week	Sales/Month
1	32	$17,000
2	40	$25,000
3	45	$26,000
4	40	$20,000
5	38	$21,000
6	50	$28,000
7	35	$15,000

To find the average workweek and sales of this sample:

Set the Print Mode switch ALL MAN NORM to MAN.

Press	Display	
f CLΣ		Statistical registers cleared.
32 ENTER↑	*32.00*	
17000 Σ+	*1.00*	First entry.
40 ENTER↑	*40.00*	
25000 Σ+	*2.00*	Second entry.
45 ENTER↑	*45.00*	
26000 Σ+	*3.00*	
40 ENTER↑	*40.00*	
20000 Σ+	*4.00*	
38 ENTER↑	*38.00*	
21000 Σ+	*5.00*	
50 ENTER↑	*50.00*	
28000 Σ+	*6.00*	
35 ENTER↑	*35.00*	
15000 Σ+	*7.00*	Total number of entries in the sample.

f $\bar{x}$	21714.29	Mean dollar sales/ month (x).
x≷y	40.00	Mean workweek in hours (y).

Note that x and y values overwrite the X- and Y-registers.

Standard Deviation

The calculator already has data from the previous example in Σ+ so to calculate the standard deviation (a measure of dispersion around the mean), simply:

Press	Display	
g s	4820.59	Dollars (s_x).
x≷y	6.03	Hours (s_y).

The HP-92 calculates standard deviation according to the formulas:

$$s_x = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}} \qquad s_y = \sqrt{\frac{\Sigma y^2 - \frac{(\Sigma y)^2}{n}}{n-1}}$$

Notice that the seven salesmen that we used is a sample. If we used *all the salesmen,* then the data would be considered a population rather than a sample.

The relationship between *sample* standard deviation (s) and *population* standard deviation (s′) is given by:

$$s' = s\sqrt{\frac{n-1}{n}}$$

Since n (number of entries) is stored in register R_{Σ_0}, you can convert sample standard deviation to population standard deviation. You already have (s) 6.03 in the display, so simply:

Press	Display	
f $\bar{x}$	21714.29	Mean (dollars).
Σ+	8.00	Number of entries + 1.
g s	4463.00	s'_x.
x≷y	5.58	s'_y.

To continue summing data pairs, press f $\bar{x}$ f Σ− before entering more data.

Linear Regression

Linear regression is a statistical method for defining a straight line that best fits a set of data points, thus providing a relationship between two variables. If there is equal time or space between data points, then this is called a trend line.

Naturally, at least two data points must be in the machine before a line can be drawn or fitted to them. After you have accumulated the data points using the Σ+ key, you can calculate the coefficients of the linear equation

$$y = A + Bx$$

by pressing f L.R. A is the y-intercept, and appears in the display. B represents the slope of the line and is stored in the Y-register.

Input Data:

(x) Lot frontage (feet)	(y) Lot value ($)
70.8	10100
60.0	9000
85.0	12700
75.2	11120
69.5	11000
84.0	12500

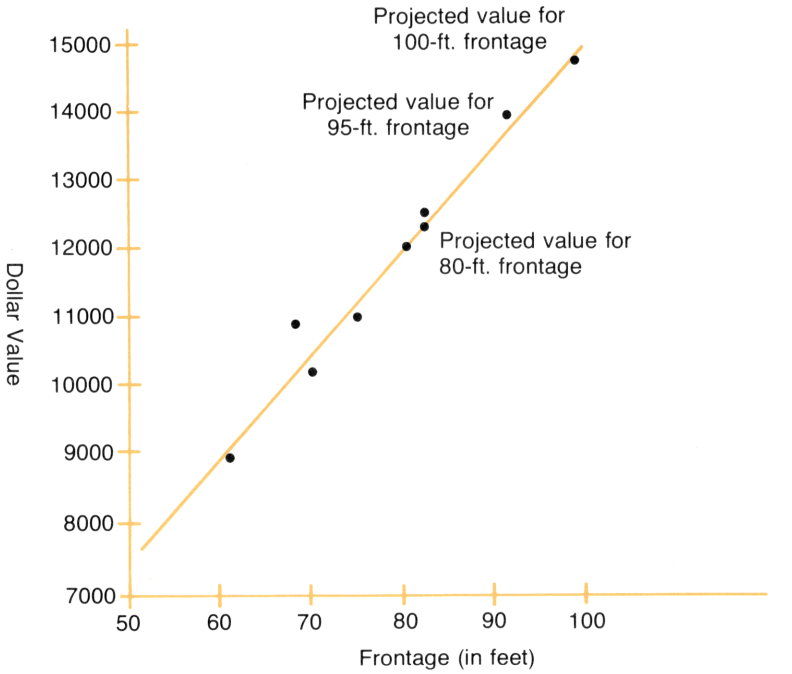
Accumulate the data using Σ+. (Remember that when you enter two values, x and y, you must enter the y value first.)

Press	Display	
f CLΣ		
10100 ENTER↑	*10100.00*	
70.8 Σ+	*1.00*	First entry.
9000 ENTER↑	*9000.00*	
60 Σ+	*2.00*	Second entry.
12700 ENTER↑	*12700.00*	
85 Σ+	*3.00*	Third entry.
11120 ENTER↑	*11120.00*	
75.2 Σ+	*4.00*	Fourth entry.
11000 ENTER↑	*11000.00*	
69.5 Σ+	*5.00*	Fifth entry.
12500 ENTER↑	*12500.00*	
84 Σ+	*6.00*	Sixth entry.
f L.R.	*393.90*	A = y-intercept.
x≷y	*144.11*	B = slope of line.

Thus, the equation of the regression line is:

$$y = 393.90 \text{ (y-intercept)} + 144.11 \text{ (the slope) } x$$

The y-intercept value represents the projected value for $x = 0$. The slope indicates the change in the projected value caused by an incremental change in the x value. Plotting this example, you see that a 1-foot increase in the frontage results in a projected increase in value of $144.11.



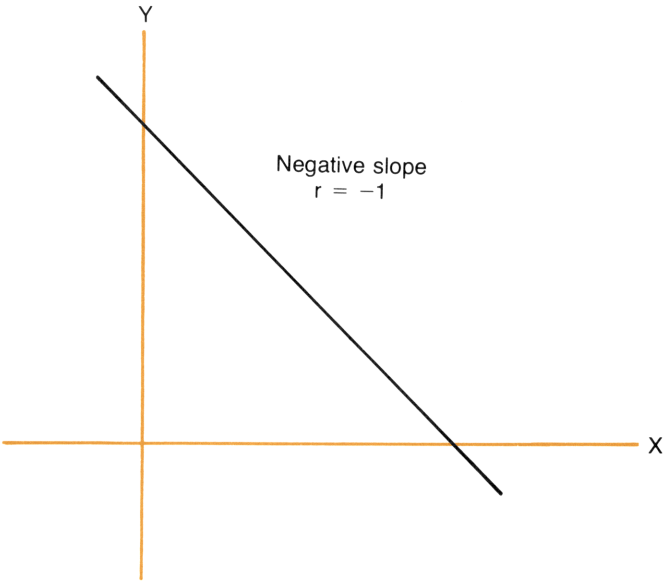
Correlation Coefficient

In the diagram, the solid line is the best fit for the given data points.

It's a good idea to check the "goodness of fit" of the linear function by calculating the correlation coefficient. This tells you how close to a straight line the data points lie. Since all the data is in your HP-92, to calculate the correlation coefficient:

Press	Display
g r	*0.97*

If r = +1, then the line has a positive (upward) slope and the data fits perfectly. If r = −1, the data still is a perfect fit but the line has a negative (downward) slope, like this:



(An example of a negative trend line is declining property values or declining sales.) If r = 0, the data values are spread out all over and do not come close to a straight line.

In the example of lot frontage related to value, the correlation coefficient is close to 1, so we can feel comfortable using linear regression. Suppose, though, that the correlation coefficient was not close to 1 but instead was 0.5 or 0.6. This would indicate that a straight line is not a very good fit to the data. Then you might try to fit a curve to the data.

The *HP-92 Applications Book* describes three different types of curves: exponential, logarithmic, and power. A correlation coefficient can be calculated for each of these curves and should be interpreted similarly: if r is close to ±1, the curve is a reasonable approximation of the data. If not, try a different curve.

Linear Estimate

Having plotted a line, you can quickly estimate other values. With the data totaled in registers $R_{\Sigma 0}$ thru $R_{\Sigma 5}$, a predicted y (designated $\hat{y}$) can be calculated by keying in an x value and pressing [ŷ].

Example 1: For the previous example, find projected values for 80-, 95-, and 100-foot frontages.

Press	Display	
80 ŷ	*11922.65*	80-foot frontage projected value.
95 ŷ	*14084.29*	95-foot frontage projected value.
100 ŷ	*14804.83*	100-foot frontage projected value.

To find an estimated value, it is not necessary to calculate L.R. first. In the next example, you key in the known data and solve for a projected unknown.

Example 2: You bought a house 3 years ago for $47,500. The first year it appreciated $5,000. The second year its value rose to $60,000. Today you figure the market price to be $64,000 if you were to sell. What will your house be worth next year?

Press	Display
f CLΣ	
47500 ENTER↑	*47500.00*
1 Σ+	*1.00*
52500 ENTER↑	*52500.00*
2 Σ+	*2.00*
60000 ENTER↑	*60000.00*
3 Σ+	*3.00*
64000 ENTER↑	*64000.00*
4 Σ+	*4.00*

To make a projection for next year (year 5), simply solve for y:

Press	Display
5 ŷ	*70250.00*

Arithmetic Functions

The HP-92 has these additional arithmetic functions:

- f LN — Log_e (natural logarithm); this takes the log of the displayed value to base e (2.718281828).
- f e^x — Antilog_e (the natural antilog); this raises e (2.718281828) to the power of the displayed value.
- f y^x — Raises a positive number to a positive or negative power; raises 0 to a positive power; or raises a negative number to an integer power.
- g RND — Rounds the internal number to match the display.
- f $\sqrt{x}$ — Finds the square root of the displayed number.
- f $1/x$ — Calculates the reciprocal of the displayed number.

Logarithms

To calculate the natural logarithm of a number, simply key in the number and press f LN. To find the $\log_e$ of 30.00:

Press	Display
30 f LN	3.40

Now, press f e^x. Because e^x is the antilog, you return to the original number, 30.

To calculate the common logarithm (base 10) of a number, key in the number, then press f LN 10 f LN ÷. To find $\log_{10}$ 5:

Press	Display
5 f LN 10	10.
f LN ÷	0.70

Example 1: The solution for n in the future value/present value formulas may be found by the following:

$$n = \frac{\ln (FV/PV)}{\ln \left(1 + \frac{i}{100}\right)}$$

Find n where PV = 100, FV = 150, and i = 8%.

Press	Display
150 ENTER↑ 100	100.
÷ f LN	0.41
8 ENTER↑ 100	100.
÷ 1 +	1.08
f LN ÷	5.27

Example 2: Logarithms are also used in continuous compound interest formulas. If a savings institution offers a 7.79% effective rate on savings compounded continuously, what nominal rate does this represent?

$$\text{Nominal rate} = 100 \times \ln \left(\frac{7.79}{100} + 1\right)$$

Press	Display	
7.79 ENTER↑	7.79	
100 ÷	0.08	
1 + f LN	0.08	
100 ×	7.50	Nominal percentage rate.

Antilogs

To calculate the antilog of a number, key in the number and press f e^x. This raises e(2.718...) to the power of the value in the display:

Press	Display
30 f e^x	*1.068647458 13*

Since you used the natural logarithm to convert continuous effective interest to the nominal rate, it follows that the antilog or e^x is used for the opposite conversion.

Example: To compute the continuous effective rate, given the nominal rate, the formula is:

$$\text{Continuous Effective Rate} = \left(e^{\left(\frac{\text{nominal rate}}{100}\right)} - 1\right) \times 100$$

So, if a savings institution quotes a nominal rate of 6%, compounded continuously, what is the effective rate?

Press	Display	
6 ENTER↑	*6.00*	
100 ÷	*0.06*	
f e^x 1 −	*0.06*	
100 ×	*6.18*	Continuous effective percentage rate.

Exponentiation: Raising a Number to a Power

The y^x key raises a positive number to a positive or negative power or a negative number to an integer power. You use it the same simple way you've performed arithmetic operations; the function is executed immediately when you press the key.

1. Key in the base number. This number is designated y.
2. Press ENTER↑ to separate the first number from the second.
3. Key in the second number (power). This number is designated as x.
4. Press f y^x.

To calculate 3^6,

Press	Display
3 ENTER↑ 6	*6.*
f y^x	*729.00*

To raise a number to a negative power, follow the same procedure and change the sign (CHS) of your exponent before you perform the operation. To solve $4.37^{-2.5}$,

Press	Display
4.37 ENTER↑	*4.37*
2.5 CHS f y^x	*0.03*

To raise a negative number to a positive or negative integer power, key in the base number, press CHS, press ENTER↑, key in the integer power, and press f y^x. To solve $(-2)^3$,

Press	Display
2 CHS ENTER↑	-2.00
3 f y^x	-8.00

With a negative base, if the exponent is an odd number, the answer will be negative. If the exponent is an even number, your answer will be positive:

$$(-2)^2 = -2 \times -2 = 4$$

$$(-2)^3 = -2 \times -2 \times -2 = -8$$

You can also use y^x to raise 0 to a positive power; but of course, your answer will always be zero.

Reciprocals

To calculate the reciprocal of a number in the displayed X-register, key in the number, then press f $1/x$. For example, to calculate the reciprocal of 25:

Press	Display
25 f $1/x$	0.04

You can also calculate the reciprocal of a value in a previous calculation without reentering the number.

Example: Solve the following problem using the $1/x$ key.

$$\frac{1}{\frac{1}{220}+\frac{1}{560}+\frac{1}{1200}+\frac{1}{5000}}$$

Press	Display	
220 f $1/x$	4.545454545-03	
560 f $1/x$	1.785714286-03	
+	0.01	
1200 f $1/x$	8.333333333-04	
+	0.01	
5000 f $1/x$	2.000000000-04	
+	0.01	Sum of reciprocals.
f $1/x$	135.79	The reciprocal of the sum of the reciprocals yields the answer.

Extracting Roots

To calculate the square root of a number, key in the number, then press f [√x].

To Solve	Press	Display
$\sqrt{25}$	25 f [√x]	*5.00*
$\sqrt{81}$	81 f [√x]	*9.00*

You must use a positive number. You cannot calculate the square root of a negative number; that's an illegal operation.

You can also extract higher roots, like cube roots and fourth roots; but you use the [y^x] key, not f [√x]. The cube root of a number is that number raised to the 1/3 power. Thus, $\sqrt[3]{n}$ is the same as $n^{1/3}$; the fourth root can be written as $n^{1/4}$ or $n^{.25}$, etc.

Use the same keystroke sequence that you learned for exponentiation to extract higher roots:

1. Key in the base number and press [ENTER↑].
2. Key in the root desired, then press f [1/x].
3. Press f [y^x].

To solve $\sqrt[n]{i}$ where i = 10 and n = 20, $(10^{1/20})$:

Press	Display
10 [ENTER↑]	*10.00*
20 f [1/x] f [y^x]	*1.12*

Now, try $\sqrt[15]{22}$.

Press	Display
22 [ENTER↑]	*22.00*
15 f [1/x] f [y^x]	*1.23*

Rounding a Number

As you know, when you change the number of digits that are displayed beyond the decimal point, the number maintains its full value to 10 digits multiplied by a two-digit exponent of ten no matter how many digits you see. When you press the g prefix key followed by the [RND] (round) key, however, the actual number in the calculator becomes the number that is in the displayed X-register. You can change the number of digits rounded by changing the number of digits displayed. For example, if the calculator is set to display four digits beyond the decimal point, the [RND] function will round the internal number to the displayed four digits. The following example shows how the [RND] function can be useful in financial calculations.

Example: Sam Simion wants to buy a new $150,000 covered swimming pool for his back yard. He decides to finance the pool for 10 years, with a final balloon payment. Sam knows that Aunt Sue's trust fund will pay him $50,000 in 10 years, and he decides to make this his balloon payment. If Sam gets 9½% financing, what will his monthly payment be? Round the payment amount using the g RND keys and recalculate the actual balloon. Set the Payment Mode switch to END.

Press	Display	
CL FIN		Set calculator to full display.
10 f 12×	*120.0000000*	Calculate number of payments, store in n.
9.5 f 12÷	*0.791666667*	Calculate monthly interest rate, store in i.
50000 CHS FV	*-50000.00000*	Enter balloon amount.
150000 PV	*150000.0000*	Enter cost of pool.
PMT	*-1689.808909*	Calculate payment.
g 2	*-1689.81*	Set calculator to display two decimal digits.
g RND	*-1689.81*	Round payment to two places.
g 9	*-1689.810000*	Return to full display to see rounded number.
PMT	*-1689.810000*	Store new payment.

Note that the payment was rounded to two decimal places. Since this changed the actual internal value for the PMT we need to recalculate the balloon amount.

Press	Display	
g 2	*-1689.81*	Return to two decimal digits.
FV	*-49999.78*	Calculate new balloon amount.

Notice that the rounding of the payment decreased the balloon amount by $0.22.

Section 8

The Display, Stack and Memory

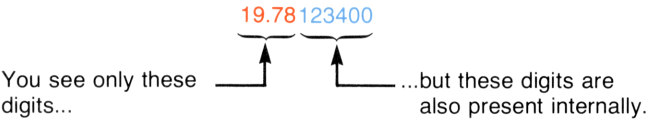
The Display

When the HP-92 is turned on, its displayed numbers are rounded to two decimal places. That's because most of your calculations deal with dollars and cents. For example, if you enter a long number, it is normally shown to only two decimal places.

Slide the Print Mode switch MAN [ALL] NORM to MAN so that you can concentrate on the display changes.

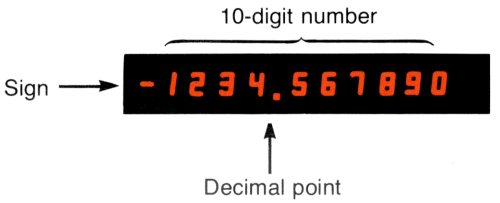
Press	Display
19.781234 ENTER↑	*19.78*

Although you only see two decimal places, the HP-92 actually calculates using a full 10-digit number internally so that you are assured of greater accuracy.



If you want to see more than two decimal places, you may select either of two formats: fixed point display or scientific notation display. *No matter which format or how many displayed digits you choose, the actual number itself inside your calculator is not altered unless you use the* RND *or* AMORT *function.* The HP-92 always calculates internally with full 10-digit accuracy.

Fixed Point Display



Using fixed point display, you can specify the number of digits to be shown after the decimal point. Press the blue prefix key 9 followed by a number (0 through 9) to specify the number of decimal places.

You already have **19.78** on the display, now try the following:

Press	Display
g 4	19.7812
g 6	19.781234
g 0	20.

The display setting remains until you specify a different one. If you turn the calculator OFF, then ON, the display returns to two decimal places (0.00) for normal business calculations.

If a calculated answer is greater or smaller than the 10-digits that fixed point notation can display, the HP-92 will automatically switch to scientific notation.

Scientific Notation Display

In scientific notation, each number is displayed with a single digit to the left of the decimal point followed by at least two digits to the right of the decimal point and multiplied by a power of 10.

Scientific notation is nothing more than a mathematical "shorthand."

	Scientific notation display	
$\$62{,}500{,}000 = 6.25 \times 10^{7}$	6.250000000 07	(Move the decimal point 7 places to the right to see the number in its original format.)
$.0000000625 = 6.25 \times 10^{-8}$	6.250000000-08	(Move the decimal point 8 places to the left to see the number in its original format.)

The two-digit exponent of 10, displayed on the right, will be positive if you are using large numbers and will be negative if you are using very small numbers.

To select scientific notation on the HP-92, press g ⊡.

Press	Display	
g 2 CLx	0.00	Fixed 2 display.
4750000 ENTER↑	4750000.00	
g ⊡	4.750000000 06	Scientific notation display.

g 2	*4750000.00*	Return to fixed 2 display.

If you are using scientific notation and turn the calculator OFF, then ON again, the display automatically returns to two decimal places: 0.00.

Automatic Display Switching

The HP-92 automatically switches the display to scientific notation whenever the number is too large or too small for fixed decimal display. For example, if you are figuring 0.05 × 0.05:

Press	Display	
CL x	*0.00*	Normal fix 2 display.
.05 ENTER↑	*0.05*	
×	*2.500000000–03*	Scientific notation.

In the normal two decimal (fixed 2) notation, you would have only seen *0.00*; so the display automatically switches to scientific notation to let you view the entire answer. (Another way of viewing the answer would be to press g 4 to obtain *0.0025*.)

Keying in Exponents of 10

If you are dealing with millions, billions or trillions of dollars, you can save keystrokes (all those zeros!) by using the EEX *(enter exponent of 10)* key. For example, to key in 15.6 trillion (15.6×10^{12}) and multiply it by 25:

Press	Display		
CL x	*0.00*		
15.6	*15.6*		
f EEX	*15.6*	*00*	
12	*15.6*	*12*	This means 15.6×10^{12}.
ENTER↑	*1.560000000*	*13*	Displayed in scientific notation.
25 ×	*3.900000000*	*14*	The answer.

This is the same as 390 trillion. (Move the decimal point 14 places to the right.)

Example: The estimated world aggregate of Gross National Product in 1971 was $3,500,000,000,000. If the 1971 GNP of the United States was $1,151,800,000,000, what was the GNP for the rest of the world?

Press	Display		
3.5 f EEX	*3.5*	*00*	
12	*3.5*	*12*	
ENTER↑	*3.500000000*	*12*	(3.5×10^{12}).

Press	Display		
1.1518 f EEX	*1.1518*	*00*	
12	*1.1518*	*12*	(1.1518×10^{12}).
−	*2.348200000*	*12*	

The GNP for the rest of the world was $2,348,200,000,000.

Format of Printed Numbers

When using the printer, whether you are in MAN or NORM mode (where you must press PRINT x or a list function to see answers) or in ALL (where the HP-92 automatically prints numbers, functions, and intermediate and final answers as they are entered and calculated), printed numbers can be shown in either display format—fixed point or scientific notation. By selecting the display format, you also select the print format.

Results from your HP-92 are always displayed and printed in the format that you have chosen. The three-asterisk label that you see printed next to a result is a guarantee that it is in the chosen display format. Although numbers in the display are left-justified, printed numbers are right-justified.

Numbers that you key in—that is, numbers that are *not* the results of operations—are also printed by the HP-92. When you key in a number with the Print Mode switch set to NORM or ALL, the HP-92 does not print it until you change display format or press a function key. Then the number is printed exactly *as you keyed it in*. A number that you keyed in is not the result of an operation, and no asterisks are printed to its right. Subsequent *results*, of course, are printed in the selected format with a three-asterisk label.

Thus, whenever you key in a number, the HP-92 prints it just as you keyed it in; *then* the format is changed. It is easy for you to reconstruct your calculation because your exact inputs are identifiable from your printed copy.

The Automatic Memory Stack

The HP automatic memory stack and its associated logic system is the most efficient method available for solving complex problems. This section describes how the HP-92 simplifies even the most complicated problems by using the automatic memory stack.

The X-Register (The Display)

Inside your calculator is a memory of four registers, "stacked" one on top of each other, like shelves. These are labelled X, Y, Z and T, with T at the top and X at the bottom, like this:

	Stack	
T	*0.00*	Top
Z	*0.00*	
Y	*0.00*	
X	*0.00*	Display (bottom)

When the calculator is switched ON, the entire machine is cleared so all four stack registers are set to 0.00.

The ENTER↑ Key

When you key a number into the calculator, its contents are written into the displayed X-register. It can be a simple digit, like 1 or 2, or it can be a long numerical sequence, like 3.141592654. Each number, no matter how simple or complex, occupies one register.

For example, when you key in 314.32, the contents of the stack registers are changed...

...from this		...to this.	
T	0.00	T	0.00
Z	0.00	Z	0.00
Y	0.00	Y	0.00
X	0.00	X	314.32

In order to key in another number at this point, you must first terminate digit entry—i.e., you must indicate to the calculator that you have completed keying in the first number and that any new digits you key in are part of a new number.

Use the ENTER↑ key to separate the digits of the first number from the digits of the second.

When you press the ENTER↑ key, the contents of the stack registers are changed...

...from this...			...to this.		
T	0.00		T	0.00	
Z	0.00		Z	0.00	
Y	0.00		Y	314.32	
X	314.32	Display	X	314.32	Display

As you can see, the number in the displayed X-register is copied into Y. The numbers in Y and Z have also been transferred to Z and T, respectively, and the number in T has been lost off the top of the stack. But this will be more apparent when we have different numbers in all four registers.

Immediately after pressing ENTER↑, the X-register is prepared for a new number, and that new number writes over the number in X. For example, key in the number 543.28 and the contents of the stack registers change...

...from this...			...to this.		
T	0.00		T	0.00	
Z	0.00		Z	0.00	
Y	314.32		Y	314.32	
X	314.32	Display	X	543.28	Display

CL x replaces any number in the display with zero. Any new number then writes over the zero in X.

For example, if you had meant to key in 689.4 instead of 543.28, you would press CL x now to change the stack...

...from this...			...to this.		
T	0.00		T	0.00	
Z	0.00		Z	0.00	
Y	314.32		Y	314.32	
X	543.28	Display	X	0.00	Display

and then key in 689.4 to change the stack...

...from this...			...to this.		
T	0.00		T	0.00	
Z	0.00		Z	0.00	
Y	314.32		Y	314.32	
X	0.00	Display	X	689.4	Display

Notice that numbers in the stack do not move when a new number is keyed in immediately after you press LIST: STACK, PRINT x, ENTER↑, or CL x, However, numbers in the stack *do* lift upward when a new number is keyed in immediately after you press most other functions, including R↓, R↑, and x≷y.

Manipulating Stack Contents

The R↓ *(roll down)*, R↑ *(roll up)*, and x≷y *(x exchange y)* keys allow you to review the stack contents or to shift data within the stack for computation at any time.

Reviewing the Stack

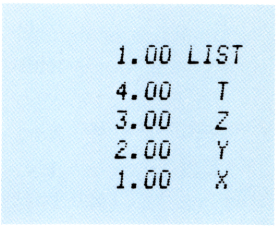
To see how the R↓ key works, first load the stack with numbers 1 through 4 by pressing:

4 ENTER↑ 3 ENTER↑ 2 ENTER↑ 1

The numbers that you keyed in are now loaded into the stack, and its contents look like this:

T	4.00	
Z	3.00	
Y	2.00	
X	1.	Display

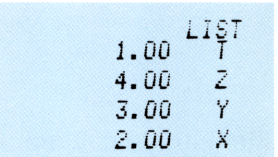
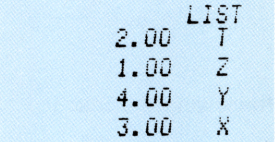
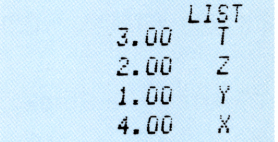
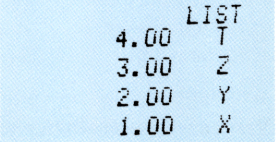
You can view the contents of the entire stack at any time by printing them using the LIST: STACK *(list stack)* function.

Press	
f LIST: STACK	

Notice that LIST: STACK, like PRINT x and the other LIST functions, operates regardless of the position of the Print Mode switch.

When you press the R↓ key, the stack contents shift downward one register. So the last number that you have keyed in will be rotated around to the T-register when you press R↓. When you press R↓ again, the stack contents again roll downward one register.

To see how the R↓ key operates, press f LIST: STACK to list the stack contents after each press of the R↓ key:

Press	Display	
R↓	2.00	
f LIST: STACK	2.00	
R↓	3.00	
f LIST: STACK	3.00	
R↓	4.00	
f LIST: STACK	4.00	
R↓	1.00	
f LIST: STACK	1.00	

Once again the number 1.00 is in the displayed X-register. Four presses of the R↓ key roll the stack down four times, returning the contents of the stack to their original registers.

You can also manipulate the stack contents using the R↑ *(roll up)* key. This key rolls the stack contents *up* instead of down, but it otherwise operates in the same manner as the R↓ key.

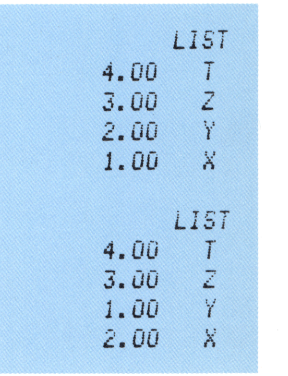
Exchanging x and y

The x≷y *(x exchange y)* key exchanges the contents of the X- and the Y-registers without affecting the Z- and T-registers. If you press x≷y with data intact from the previous example, the numbers in the X- and Y-registers will be changed...

...from this...		...to this.	
T 4.00		T 4.00	
Z 3.00		Z 3.00	
Y 2.00		Y 1.00	
X 1.00	Display	X 2.00	Display

You can verify this by first listing the stack contents and then pressing x≷y. To see the results, list the stack contents again:

Press	Display
f LIST: STACK	1.00
x≷y	2.00
f LIST: STACK	2.00



Notice that whenever you move numbers in the stack using one of the data manipulation keys, the actual stack registers maintain their positions. Only the *contents* of the registers are shifted. The contents of the X-register are always displayed.

Clearing the Stack

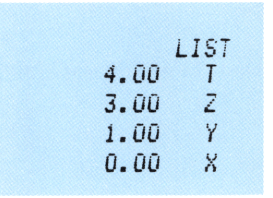
To clear the displayed X-register only, press CL x. To clear the entire automatic memory stack, including the displayed X-register, press f CLEAR. This replaces all numbers in the stack with zeros. (It also clears all manual storage registers—more about these later.) When you turn the calculator OFF, then ON, it "wakes up" with all zeros in the stack registers.

Although it may be comforting, *it is never necessary to clear the stack or the displayed X-register when starting a new calculation.* This will become obvious when you see how old results in the stack are automatically lifted by new entries.

Press CLx now, and the stack contents are changed...

...from this...		...to this.	
T 4.00		T 4.00	
Z 3.00		Z 3.00	
Y 1.00		Y 1.00	
X 2.00	Display	X 0.00	Display

Press	Display
f LIST: STACK	0.00



One-Number Functions and the Stack

One-number functions execute upon the number in the X-register only, and the contents of the Y-, Z-, and T-registers are unaffected when a one-number function key is pressed.

Press	Display
314.32 ENTER↑	314.32
689.4	689.4
f √x	26.26

Pressing the f √x key changes the stack contents...

...from this...		...to this.	
T 3.00		T 3.00	
Z 1.00		Z 1.00	
Y 314.32		Y 314.32	
X 689.4	Display	X 26.26	Display

The one-number function executes upon only the number in the displayed X-register, and the answer writes over the number that was in the X-register. No other register is affected by a one-number function.

Two-Number Functions and the Stack

Hewlett-Packard calculators do arithmetic by positioning the numbers in the stack the same way you would on paper. For instance, if you wanted to add 34 and 21 you would write 34 on a piece of paper and then write 21 underneath it, like this:

```
 34
 21
----
```

and then you would add, like this:

```
 34
+21
----
 55
```

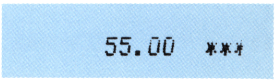
Numbers are positioned the same way in the HP-92. Here's how it is done. (If you clear the stack first by pressing f CLEAR, the numbers in the stack will correspond to those shown here in the example.)

Press	Display	
f CLEAR	*0.00*	
34	*34.*	34 is keyed into X.
ENTER↑	*34.00*	34 is copied into Y.
21	*21.*	21 writes over the 34 in X.

Now 34 and 21 are sitting vertically in the stack as shown below, so we can add.

T *0.00*
Z *0.00*
Y *34.00*
X *21.* Display

Press	Display	
+ PRINT x	*55.00*	The answer.



The simple, old-fashioned math notation helps explain how to use your calculator. Both numbers are always positioned in the stack in the natural order first; then the operation is executed when the function key is pressed. *There are no exceptions to this rule.* Subtraction, multiplication, and division work the same way. In each case, the data must be in the proper position before the operation can be performed.

Chain Arithmetic

You've already learned how to key numbers into the calculator and perform calculations with them. In each case you first needed to position the numbers in the stack manually using the ENTER↑ key. However, the stack also performs many movements automatically. These automatic movements add to its computing efficiency and ease of use, and it is these movements that automatically store intermediate results. The stack automatically "lifts" every calculated number in the stack when a new number is keyed in because it knows that after it completes a calculation, any new digits you key in are a part of a new number. Also, the stack automatically "drops" when you perform a two-number operation.

To see how it works, let's solve

$$(2 + 3) \times (4 + 5) = ?$$

If you press f CLEAR first, you will begin with zeros in all of the stack registers, as in the example below; but of course, you can also do the calculation without first clearing the stack.

> **Note:** You can use the LIST: STACK function to monitor the changes in the stack contents.

So that your printer tapes will match those in the following examples, set the Print Mode Switch MAN ALL NORM to NORM.

Press	Stack Contents	
f CLEAR	T 0.00 Z 0.00 Y 0.00 X 2.	2 is keyed into the displayed X-register.
ENTER↑	T 0.00 Z 0.00 Y 2.00 X 2.00	2 is copied into Y.
3	T 0.00 Z 0.00 Y 2.00 X 3.	3 writes over the 2 in X.
+	T 0.00 Z 0.00 Y 0.00 X 5.00	2 and 3 are added together. The answer, 5, is displayed.
4	T 0.00 Z 0.00 Y 5.00 X 4.	4 is keyed into the displayed X-register. The 5 in the stack is automatically raised.
ENTER↑	T 0.00 Z 5.00 Y 4.00 X 4.00	4 is copied into Y and 5 moves up into Z.
5	T 0.00 Z 5.00 Y 4.00 X 5.	5 writes over the 4 in X.
+	T 0.00 Z 0.00 Y 5.00 X 9.00	4 and 5 (Y and X) are added together. The answer, 9, is displayed.
×	T 0.00 Z 0.00 Y 0.00 X 45.00	5 and 9 are multiplied together for the final answer.
PRINT x		

```
      CLEAR
2.00  ENT↑
3.00     +
4.00  ENT↑
5.00     +
         x
45.00  ***
```

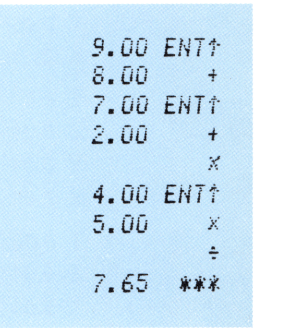
Notice that the stack automatically lifts when a new number is keyed in and automatically drops during calculations involving the X- and Y-registers. This automatic lift and drop of the stack give you tremendous computing power since you can retain and position intermediate results in long calculations without the necessity of reentering numbers.

No matter how complicated a problem may look, it can always be reduced to a series of one- and two-number operations. Just work through the problem in the same logical order you would use if you were working it with a pencil and paper.

For example, to solve:

$$\frac{(9 + 8) \times (7 + 2)}{(4 \times 5)}$$

Press	Display	
9 ENTER↑ 8 +	*17.00*	Intermediate result of (9 + 8).
7 ENTER↑ 2 +	*9.00*	Intermediate result of (7 + 2).
×	*153.00*	(9 + 8) multiplied by (7 + 2).
4 ENTER↑ 5 ×	*20.00*	Intermediate result of (4 × 5).
÷	*7.65*	The final answer.
PRINT X	*7.65*	



Now try these problems. Remember to work through them as you would with a pencil and paper, but don't worry about intermediate answers—they're handled automatically by the calculator.

$$(2 \times 3) + (4 \times 5) = \textit{26.00}$$

$$\frac{(14 + 12) \times (18 - 12)}{(9 - 7)} = \textit{78.00}$$

$$\frac{\sqrt{16.3805 \times 5}}{.05} = \textit{181.00}$$

$$4 \times (17 - 12) \div (10 - 5) = \textit{4.00}$$

$$\sqrt{(2 + 3) \times (4 + 5)} + \sqrt{(6 + 7) \times (8 + 9)} = \textit{21.57}$$

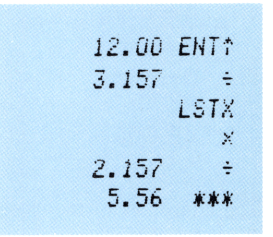
LAST X

In addition to the four stack registers that automatically store intermediate results, the HP-92 also contains a separate automatic register, the LAST X register. This register preserves the value that was in the displayed X-register before the performance of a function. To place the contents of the LAST X register into the display again, press f LAST X.

LAST X makes it easy to recover from keystroke mistakes, such as pressing the wrong function key or keying in the wrong number.

Example: Divide 12 by 2.157 after you have mistakenly divided by 3.157.

Press	Display	
12	*12.*	
ENTER↑	*12.00*	
3.157 ÷	*3.80*	Oops! You made a mistake.
f LAST X	*3.16*	Retrieves that last entry (3.157).
×	*12.00*	You're back at the beginning.
2.157 ÷	*5.56*	The correct answer.
PRINT x	*5.56*	

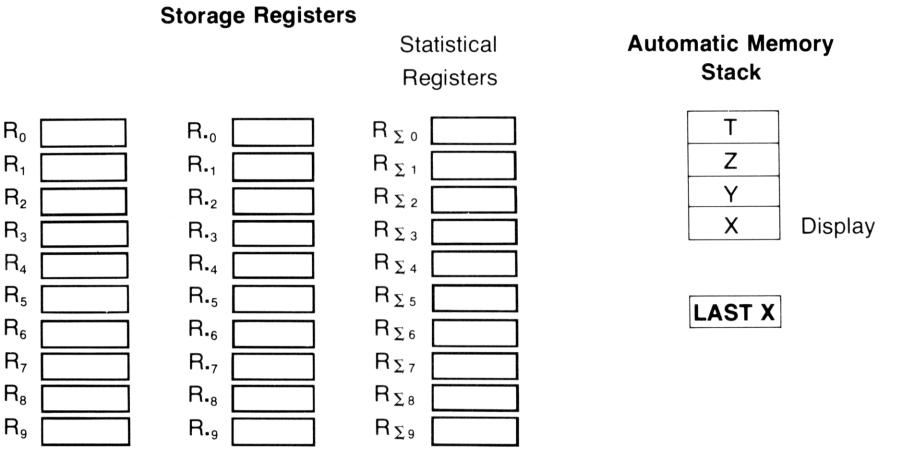


In this example, when LAST X is pressed, the contents of the stack are changed...

...from this...		...to this.	
T *0.00*		T *0.00*	
Z *0.00*		Z *0.00*	
Y *0.00*		Y *3.80*	
X *3.80*		X *3.16*	
	LAST X *3.16*		LAST X *3.16*

Storage Registers

In addition to automatic storage of intermediate results that is provided by the four-register automatic memory stack, the HP-92 also has 30 addressable storage registers that are unaffected by operations within the stack. These storage registers allow you to set aside numbers as constants or for use in later calculations.



The addresses of the storage registers are indicated by number keys [0] through [9], by [•][0] through [•][9], and by [Σ+][0] through [Σ+][9]. When you key in a number followed by [Σ+], various summations are stored in the six statistical registers. These registers are explained in section 7, (page 67).

Storing a number copies the displayed number into a designated storage register, and leaves the displayed number in the X-register.

When you recall a number, it is copied from the storage register into the display (X-register), and it also remains in the storage register. You can recall a number from a storage register any number of times without altering it—the number will remain in the storage register until you overwrite it by storing another number there or until you clear the storage registers. Statistical registers can also be changed by performing a summation operation: [Σ+] or [Σ−].

Recalling a number causes the stack to lift unless the preceding keystroke was [ENTER↑], [CL x], or [Σ+].

Listing the Storage Registers

You can see the contents of 20 (non-statistical) storage registers ([0] through [9], [•][0] through [•][9]) at any time by pressing [f] LIST [REG] to print the contents of the non-statistical storage registers. If you want only a partial listing of storage registers, you can stop the printing of them at any time by pressing any key on the keyboard.

To view the contents of the statistical registers, press [f] LIST: [Σ].

Clearing the Storage Registers

When you recall a number, the number remains in the storage register until you clear it or write over it by storing another number.

- To replace a number in a storage register, merely store another number there. To clear a specific storage register, replace the number in it with zero. For example, to clear storage register R_2, press 0 STO 2.
- To clear the entire calculator, press f CLEAR or turn your calculator OFF, then ON.
- To clear the general-purpose storage registers R_0 through R_9 and $R._0$ through $R._9$ while leaving the financial registers, the statistics registers, and the stack intact, press f CL REG *(clear registers)*.
- To clear statistical storage registers R_{Σ_0} through R_{Σ_9} while leaving the general-purpose storage registers, the financial registers and the stack intact, press f CLΣ.

Storage Register Arithmetic

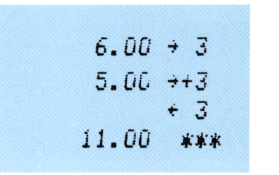
Arithmetic can be performed *upon* the contents of storage registers R_0 through R_9 by pressing STO followed by the arithmetic function key followed in turn by the register address. For example:

Press	Result
STO + 1	Number in displayed X-register added to contents of storage register R_1, and sum placed into R_1.
STO − 2	Number in displayed X-register subtracted from contents of storage register R_2, and difference placed into R_2.
STO × 3	Number in displayed X-register multiplied by contents of storage register R_3, and the product placed into R_3.
STO ÷ 4	Contents of storage register R_4 divided by number in displayed X-register, and quotient placed into register R_4.

When storage register arithmetic operations are performed, the answer is written into the selected storage register, while the contents of the displayed X-register and the rest of the stack remain unchanged.

For example, to store 6 in register R_3 and add 5:

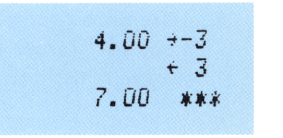
Press	Display	
6 STO 3	6.00	Stores 6 in register R_3.
5 STO + 3	5.00	Adds 5 to register R_3.
RCL 3	11.00	Confirms that 11 is
PRINT x	11.00	stored in register R_3.



If you had pressed: 5 STO 3 +, that would overwrite the stored 6 with the 5—the value stored in register R_3 would be 5, not 11.

Now, subtract 4 from the number in register R_3:

Press	Display
4 STO − 3	*4.00*
RCL 3	*7.00*
PRINT x	*7.00*



Notice that the general rule is:

Number in display, STO, operation, register number.

Appendix A

Accessories, Maintenance and Service

Standard Accessories

Your HP-92 comes complete with the following standard accessories:

Accessory	HP Number
Battery Pack (installed in calculator before packaging)	82033A
HP-92 Owner's Handbook	00092-90002
HP-92 Applications Book	00092-90011
AC Adapter/Recharger (one of the following)	
U.S. (90-127 Vac, 50-60 Hz)	82059A
European (200-254 Vac, 50-60 Hz)	82066A
European (90-127 Vac, 50-60 Hz)	82069A
Australian (200-254 Vac, 50-60 Hz)	82068A
U.K. (Desktop, 200-254 Vac, 50-60 Hz)	82067A
Carrying Case	82035A

Your HP-92 also comes standard with two rolls of paper.

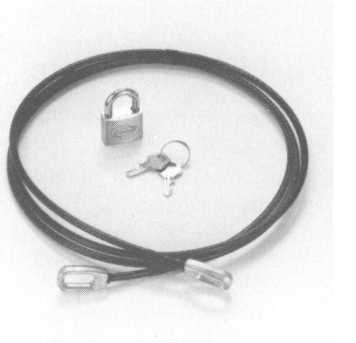
You can purchase additional standard accessories from your nearest dealer or by mail from Hewlett-Packard. Refer to Optional Accessories below for information on how to order.

Optional Accessories

Security Cable 82044A

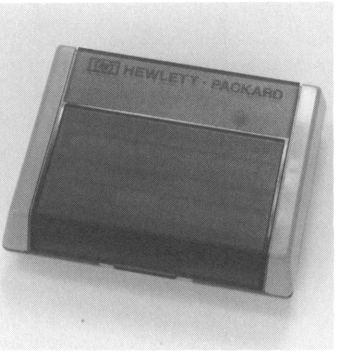
A tough, 6-foot long steel cable that prevents unauthorized borrowing or pilferage of your calculator by locking it to a desk or work surface. The cable is plastic-covered to preclude scarring of furniture, and you have full access to all features of your HP-92 at all times.

Comes complete with lock.



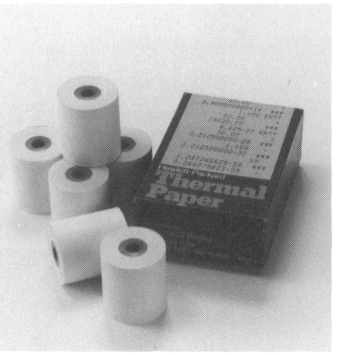
Reserve Power Pack 82037A

The reserve power pack attaches to the calculator's ac adapter/recharger to keep an extra battery pack freshly charged and ready for use. Comes complete with extra battery pack.



Paper Rolls 82045A

Each pack gives you six rolls of special Hewlett-Packard thermal paper for your HP-92 printer.



To order additional standard or optional accessories for your HP-92 see your nearest dealer or fill out an Accessory Order Form and return it with check or money order to:

Hewlett-Packard
Corvallis Division
1000 NE Circle Blvd.
Corvallis, OR 97330

If you are outside the U.S., please contact the Hewlett-Packard Sales Office nearest you.

Availability of all accessories, standard or optional, is subject to change without notice.

AC Line Operation

Your calculator contains a rechargeable battery pack that contains nickel-cadmium batteries. When you receive your calculator, the battery pack inside may be discharged, but you can operate the calculator immediately by using the ac adapter/recharger. Even though you are using the ac adapter/recharger, the batteries must remain in the calculator whenever the calculator is used.

> **Note:** Attempting to operate the HP-92 from the ac line with the battery pack removed may result in wrong or improper displays.

The procedure for using the ac adapter/recharger is as follows:

1. You need not turn the HP-92 OFF.
2. Insert the female ac adapter/recharger plug into the rear connector of the HP-92.
3. Insert the power plug into a live ac power outlet.

> **CAUTION**
> The use of a charger other than the HP recharger supplied with the calculator may result in damage to your calculator.

Battery Charging

The rechargeable batteries in the battery pack are being charged when you are operating the calculator from the ac adapter/recharger. With the batteries in the calculator and the recharger connected, the batteries will charge with the calculator OFF or ON. Normal charging times from fully discharged battery pack to full charge are:

Calculator OFF: 7–10 hours
Calculator ON: 17 hours

Shorter charging periods will reduce the operating time you can expect from a single battery charge. Whether the calculator is OFF or ON, the HP-92 battery pack is never in danger of becoming overcharged even if it feels warm.

> **Note:** It is normal for the ac adapter/recharger to be warm to the touch when it is plugged into an ac outlet.

Battery Operation

To operate the HP-92 from battery power alone, simply disconnect the female recharger plug from the rear of the calculator. (Even when not connected to the calculator, the ac adapter/recharger may be left plugged into the ac outlet.)

Using the HP-92 on battery power gives the calculator full portability, allowing you to carry it nearly anywhere. A fully charged battery pack provides approximately 3 to 6 hours of continuous operation. By turning the power OFF when the calculator is not in use, the charge on the HP-92 battery pack should easily last throughout a normal working day.

The printer is the most power-consuming part of your HP-92, and you can maximize battery operating time by leaving the calculator in MAN 

printing mode when printing is not necessary.

Battery Pack Replacement

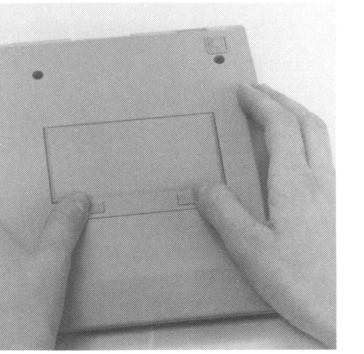
If it becomes necessary to replace the battery pack, use only another Hewlett-Packard battery pack like the one shipped with your calculator.

> **CAUTION**
> Use of any batteries other than the Hewlett-Packard battery pack may result in damage to your calculator.

To replace your battery pack, use the following procedure:

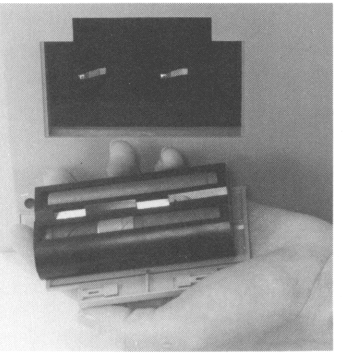
1. Turn the ON-OFF switch to OFF and disconnect the ac adapter/recharger from the calculator.

2. Slide the two battery door latches inward.

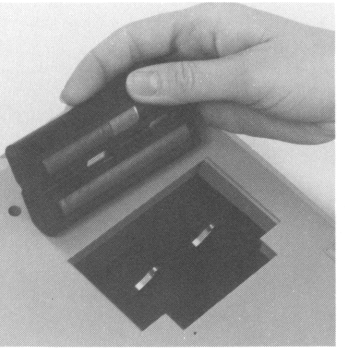


3. Let the battery door and battery pack fall into the palm of your hand.

4. If the battery connector springs have been flattened inward, bend them slightly outward again.

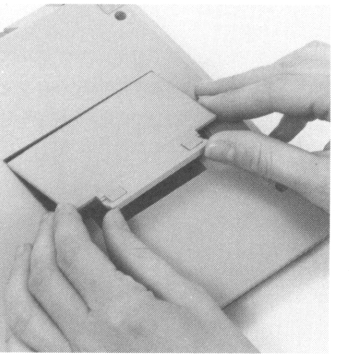


5. Insert the new battery pack so that its contacts face the calculator and line up with the connector springs.



6. Insert the end of the battery door opposite the latches behind the retaining groove and close the door.

7. Secure the battery door by pressing it gently while sliding the two battery door latches outward.



Battery Care

When not being used, the batteries in your HP-92 have a self-discharge rate of approximately 1% of available charge per day. After 30 days, a battery pack could have only 50 to 75% of its charge remaining, and the calculator might not even turn on. If a calculator fails to turn on, you should substitute a charged battery pack, if available, for the one in the calculator or operate the calculator from the ac adapter/recharger. The discharged battery pack should be charged for at least 14 hours.

If a battery pack will not hold a charge and seems to discharge very quickly in use, it may be defective. The battery pack is warranted for one year. If the warranty is in effect, return the defective pack to Hewlett-Packard according to the shipping instructions. (If you are in doubt about the cause of the problem, return the complete HP-92 along with its battery pack and ac adapter/recharger.) If the battery pack is out of warranty, see your nearest dealer or use the Accessory Order Form provided with your HP-92 to order a replacement.

WARNING

Do not attempt to incinerate or mutilate your HP-92 battery pack—the pack may burst or release toxic materials.

Do not connect together or otherwise short circuit the battery terminals—the pack may melt or cause serious burns.

To maximize the life you get from your battery pack, keep printing to a minimum and display only the fewest number of digits necessary during portable operation.

Your HP-92 Printer

The printing device in your HP-92 is a thermal printer that uses a moving print head to print upon a special heat-sensitive paper. When the print head is energized, it heats the paper beneath it. The heat causes a chemical change in the paper, which then changes color. The printer in your HP-92 prints answers quickly and quietly, and has been expressly designed to give you a permanent record of your computation in a portable financial calculator.

Paper for your HP-92

Because the printer in your HP-92 is a thermal printer, it requires special heat-sensitive paper. You should use only the Hewlett-Packard thermal paper available in 80-foot rolls from your nearest HP distributor or sales office, or by mail from:

Hewlett-Packard
Corvallis Division
1000 NE Circle Blvd.
Corvallis, OR 97330

Because of the special heat-sensitive requirements of the paper, standard adding machine paper will *not* work in the HP-92. Also, since different types of thermal paper vary in their sensitivities, the use of thermal paper other than that available from Hewlett-Packard may result in poor print quality or even in damage to your calculator.

CAUTION
Use only Hewlett-Packard paper in your HP-92.

The heat-sensitive paper used in your HP-92 should be stored in a cool, dark place. Discoloration of paper may occur if it is exposed to direct sunlight for long periods of time, if storage temperatures rise above 50°C (122°F), or if the paper is exposed to excessive humidity or to acetone, ammonia, or other organic compounds. (Exposure to gasoline or oil fumes will not harm your HP-92 paper supply.)

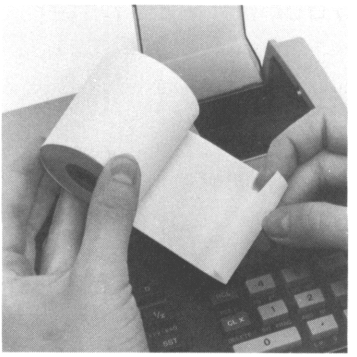
Printed tapes from your HP-92 will last 30 days or more without fading under fluorescent light, but to ensure the permanence of your records, you should store printed tapes at room temperature in a dark place away from direct sunlight, heat, or fumes from organic compounds. (For added permanence, you can copy tapes with a suitable office copier.)

Replacing Paper

To replace the paper roll in your HP-92, proceed as follows:

1. Open the paper roll cover and remove the empty core from the paper well.

2. Before inserting the new roll of paper into the calculator, discard the first 2/3 turn to ensure that no glue, tape, or other foreign matter is on the paper.



3. Fold the leading edge of the paper and crease the fold with your fingernail.

4. Temporarily place the paper roll into the paper roll cover and insert the leading edge of paper into the slot near the bottom of the paper well.

5. Turn the calculator ON-OFF switch to ON and press the paper advance pushbutton several times until the leading edge of paper becomes visible beneath the clear plastic tear bar. You can remove the tear bar for accessibility, if desired.
6. Drop the roll of paper into the paper well and close the paper roll cover.

When there is no paper in the calculator, the paper advance pushbutton operates, but the printer does not.

Printer Maintenance

The printer in your HP-92, like the rest of the calculator, is crafted for engineering excellence and is designed to give trouble-free operation with a minimum of maintenance. All moving parts in the printer mechanism contain self-lubricating compound, and no lubrication, cleaning, or servicing of the mechanism is ever required. You may want to occasionally remove the clear plastic tear bar and clean it with mild soap and water solution. (Do not use acetone or alcohol to clean the tear bar.)

You should *never* attempt to insert a tool, such as a screwdriver, or pencil into the printer or its mechanism. If the paper tape should become jammed and fail to feed properly, clear it by grasping the tape and pulling it forward or backward through the printer mechanism. (You can remove the plastic tear bar for accessibility.)

If the paper is feeding properly through the printer mechanism, but no printing appears on the tape, the paper roll is probably inserted backwards. (The paper is chemically treated, and will print on only one side.) Tear off the leading edge of paper, open the paper roll cover and grasp the paper roll, and pull it backward to remove the paper tape that is in the print mechanism. Reverse the paper roll and feed it back into the printing mechanism as described earlier under Replacing Paper.

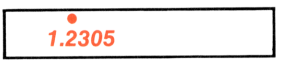
If, after reversing, there is still no printing on the tape when you press PRINT X or other print functions, remove the paper roll and insert a new roll of Hewlett-Packard thermal paper.

Note: Printer operation may be affected if the printer is in close proximity to a strong magnetic field. Normal operation can be restored by removing the calculator from the vicinity of the magnetic field. No permanent damage will result.

Service

Low Power

When you are operating from battery power, a bright red lamp inside the display will glow to warn you that the battery is close to discharge.



Low Power Display

You must then either connect the ac adapter/recharger to the calculator as described under AC Line Operation, or you must substitute a fully charged battery pack for the one in the calculator.

Blank Display

If the display blanks out, turn the HP-92 OFF, then ON. If *0.00* does not appear in the display, check the following:

1. If the ac adapter/recharger is attached to the HP-92, make sure it is plugged into an ac outlet.
2. Examine the battery pack to see if the contacts are dirty.
3. Substitute a fully charged battery pack, if available, for the one that was in the calculator.
4. If the display is still blank, try operating the HP-92 using the recharger (with the batteries in the calculator).
5. If, after step 4, the display is still blank, service is required. (Refer to Warranty paragraphs.)

Temperature Range

Temperature ranges for the calculator are:

Operating	0° to 45°C	32° to 113°F
Charging	15° to 40°C	59° to 104°F
Storage	–40° to 55°C	–40° to 131°F

Warranty

Full One-Year Warranty

The HP-92 is warranted against defects in materials and workmanship for one (1) year from date of purchase. During the warranty period Hewlett-Packard will repair or, at its option, replace at no charge components that prove to be defective, provided the calculator or accessory is returned, shipping prepaid, to a Hewlett-Packard Repair Center

This warranty does not apply if the calculator or accessory has been damaged by accident or misuse, or as a result of service or modification by other than an authorized Hewlett-Packard Repair Center. No other express warranty is given by Hewlett-Packard. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR CONSEQUENTIAL DAMAGES.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you also may have other rights which vary from state to state.

Out of Warranty

After the one-year warranty period, there is a charge for repairs. All repairs are warranted for 90 days.

Warranty Transfer

If you sell your calculator or give it as a gift, the warranty is transferred to the new owner and remains in effect until the original one-year expiration date. It is not necessary to notify Hewlett-Packard of the transfer.

Warranty Information Toll Free Number

(800) 648-4711 (In Nevada, call collect 702-323-2704)

Repair Centers

Hewlett-Packard maintains Repair Centers in most major countries throughout the world. You may have your calculator repaired at a Hewlett-Packard Repair Center anytime it needs service, whether the unit is under warranty or not.

Shipping Instructions

Whether the unit is under warranty or not, it is your responsibility to pay shipping charges to the Hewlett-Packard Customer Service Facility.

After warranty repairs are completed, the Customer Service Facility returns the unit with postage prepaid. On out-of-warranty repairs, the unit is returned C.O.D. (covering shipping costs and the service charge).

The mailing address is:

Hewlett-Packard Company
Corvallis Division Service Facility
P.O. Box 999
Corvallis, Oregon 97330

Further Information

Service contracts are not available. Calculator circuitry and design are proprietary to Hewlett-Packard, and service manuals are not available to customers.

Should other problems or questions arise regarding repairs, please call your nearest Hewlett-Packard Sales Office or Customer Service Facility.

Appendix B

Error Conditions

If you attempt a calculation containing an improper operation, the calculator will display *Error*. In addition, if the Print Mode switch is set to NORM or ALL, the word ERROR will be printed. When you receive an error during a statistical or financial calculation, it is suggested that you print the corresponding registers to see their contents and aid you in determining the source of the error.

Function	Error Condition
÷	When x = 0.
y^x	1. When y = 0 and x ≤ 0. 2. When y < 0 and x is non-integer.
$\sqrt{x}$	When x = 0.
LN	When x ≤ 0.
Δ%	When y = 0.
$1/x$	When x = 0.
STO ÷ 0 through 9	When x = 0.
Dates[1]	
g PRINT x (PRINT DATE)	When x is invalid date format.
ΔDAYS	When x or y is invalid date format.
DATE+DAYS	1. When y is invalid date format. 2. When result is invalid date format.
Statistics[2]	
$\bar{x}$	When n = 0.
s	1. When n ≤ 0 or n = 1. 2. When SS_x < 0. 3. When SS_y < 0.
L.R.	1. When n = 0 or n = 1. 2. When SS_x = 0.
$\hat{y}$	1. When n = 0 or n = 1. 2. When SS_x = 0.
r	When SS_x or SS_y ≤ 0.
%Σ	When Σx = 0.
Bonds and Notes	
IS,ST	1. When in NOTE mode and x or y is invalid date format.[1] 2. When in BOND mode and x is invalid date format.[1]
MT	When x is invalid date format.[1]
PRICE	1. When IS,ST (settlement date) ≥ MT. 2. When in NOTE mode and IS,ST (issue or settlement dates) or MT is invalid date format.[4]

3. When in BOND mode and [IS.ST] (settlement date) or [MT] is invalid date format.[4]
4. When in BOND mode and [MT] minus [IS.ST] (settlement date) is greater than 6 months and [YIELD] ≤ -200.

[YIELD]

1. When [IS.ST] (settlement date) $\geq$ [MT].
2. When [PRICE] and [CPN] $= 0$.
3. When in NOTE mode and [IS.ST] (issue or settlement dates), or [MT] is invalid date format.[4]
4. When in BOND mode and [IS.ST] (settlement date) or [MT] is invalid date format.[4]
5. When in BOND mode and [MT] minus [IS.ST] (settlement date) is greater than 6 months and [PRICE] $= 0$.

Depreciation

[LIFE]

When $x \leq 0$.

[N1] or [N2]

1. When $x < 1$.
2. When x is non-integer.

[SL], [DB], or [SOYD]

1. When [N1] $>$ [N2].
2. When [N1] or [N2] $= 0$.[3]
3. When [N1] or [N2] is non-integer.

Amortization

[P1] or [P2]

1. When $x < 1$.
2. When x is non-integer.

[AMORT]

1. When [P1] $>$ [P2].
2. When [P1] or [P2] $= 0$.[3]
3. When [P1] or [P2] is non-integer.[3]

Compound Interest

[NPV]

1. When [n] > 30 or [n] < 0.
2. When [n] is non-integer.
3. When [i] ≤ -100.

[IRR]

1. When [n] > 30 or $n \leq 0$.
2. When [n] is non-integer.
3. When $CF_0 = 0$.
4. When result would be -100%.

[n]

1. When [PMT] equals interest amount because *any* [n] is a solution.[5]
2. When the values in [i], [PV], [PMT], [FV] are such that no solution exists for [n].[6]

[i]

1. When [n] ≤ 0.9.[7]
2. When cash flows are illegal.[8]
3. When overflow/underflow occurs in the computation.

[PV], [FV], or [PMT]

When overflow/underflow occurs in the computation.

Footnotes:

1. Invalid date format is either out of range or illegal date. Out of range is when date is before October 15, 1582, or later than November 25, 4046. An illegal date is one that does not represent an actual date (e.g., 2.311977)

2. An error condition will occur if improper data have been stored in the statistical registers (R_{Σ_0} through R_{Σ_5}). SS is the summation of data squared.

$$SS_x = \frac{(R_{\Sigma_0})(R_{\Sigma_2}) - (R_{\Sigma_1})(R_{\Sigma_1})}{R_{\Sigma_0}}$$

$$SS_y = \frac{(R_{\Sigma_0})(R_{\Sigma_4}) - (R_{\Sigma_3})(R_{\Sigma_3})}{R_{\Sigma_0}}$$

3. Even though it is impossible to store invalid values directly into these registers, it is possible to store *indirectly* using CL FIN, CLEAR, IS.ST, or MT. The CL FIN and CLEAR operations store zeros into the registers.

4. Even though it is impossible to store invalid values directly into these registers, it is possible to store *indirectly* using CL FIN, CLEAR, P1, P2, N1, N2, or PMT. The CL FIN and CLEAR operations store zeros into the registers.

5. In a loan problem if the payment is equal to the interest, PV, PMT, FV, and i remain the same for all values of n (called the perpetuity problem). Since n is not determined by the data, solving for n will produce ***Error***.

6. Attempting to solve problems containing unreasonable values will produce an error condition. Example: i = 7%, PV = 200, PMT = −200, and FV = 50.00. The PMT is less than the interest and yet the FV is smaller than the PV.

7. If n is less than 1 the problem should be treated as a simple interest problem.

8. Problems involving positive PV, FV and negative PMT or negative PV, FV and positive PMT, or if all cash flows are in the same direction will produce an error condition if you attempt to solve for i. These problems may involve two interest rates.

Appendix C

Financial Formulas

Percentage

$$\% = \frac{\text{Base (y)} \times \text{Rate (x)}}{100}$$

$$\Delta\%. = \left(\frac{\text{New Amount (x)} - \text{Base (y)}}{\text{Base (y)}}\right) \times 100$$

Compound Interest

n = number of compounding periods

i = periodic interest rate, expressed as %

PV = present value

FV = future value or balance

PMT = periodic payment

S = Payment Mode switch position factor (0 or 1) indicating treatment of PMT; 0 corresponds to END, 1 to BEGIN.

r = i/100, periodic interest rate expressed as decimal

$$0 = PV + (1 + rS)\,PMT\left[\frac{1 - (1 + r)^{-n}}{r}\right] + FV\,(1 + r)^{-n}$$

Net Present Value

NPV = net present value of a discounted cash flow

cf_j = cash flow at period j

$$NPV = cf_0 + \frac{cf_1}{(1 + r)^1} + \frac{cf_2}{(1 + r)^2} + \ldots + \frac{cf_n}{(1 + r)^n}$$

Amortization

P1 = first period of amortization schedule

P2 = last period of amortization schedule

INT_j = amount of PMT applied to interest in period j

PRN_j = amount of PMT applied to principal in period j

j = period number

$$BAL_j = BAL_{j-1} - PRN_j; \quad BAL_0 = |PV|$$

$$INT_1 = |PV| \times \frac{i}{100}$$

$$PRN_1 = |PMT| - INT_1$$

$$BAL_1 = |PV| - PRN_1$$

.

.

.

$$INT_j = BAL_{j-1} \times \frac{i}{100}$$

$$PRN_j = |PMT| - INT_j$$

$$\Sigma INT = \sum_{j=P1}^{P2} INT_j = INT_{P1} + INT_{P1+1} + \ldots + INT_{P2}$$

$$\Sigma PRN = \sum_{j=P1}^{P2} PRN = PRN_{P1} + PRN_{P1+1} + \ldots + RPN_{P2}$$

Depreciation

LIFE = asset's depreciable life (years)

BOOK = starting book value

SAL = salvage value

N1 = first period of depreciation schedule

N2 = last period of depreciation schedule

FACT = declining balance factor expressed as %

j = period number

DPN_j = depreciation expense during period j

RDV_j = remaining depreciable value at end of period j = $RDV_{j-1} - DPN_j$ where $RDV_0 = BOOK - SAL$

RBV_j = remaining book value = $RBV_{j-1} - DPN_j$ where $RBV_0 = BOOK$

- Straight-Line Depreciation

$$DPN_j = \frac{BOOK - SAL}{LIFE} \quad \text{for } j = 1, 2, \ldots$$

- Sum-of-the-Years'-Digits Depreciation

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

where W = integer part of LIFE
F = fractional part of LIFE

$$DPN_j = \frac{(LIFE - j + 1)}{SOYD} (BOOK - SAL)$$

- Declining Balance Depreciation

$$DPN_j = RBV_{j-1} \left(\frac{FACT}{100 \times LIFE} \right)$$

Calendar

Actual

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

where

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

and

for $mm \leq 2$

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

for $mm > 2$

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

30/360 Basis

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

for f(DT1)

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

for f(DT2)

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

Bonds and Notes

Reference:

Spence, Bruce M. and others, Standard Securities Calculation Methods, Securities Industry Association, 1973.

DIM/b = days between issue date and maturity date/day basis from calendar switch

DSM/b = days between settlement date and maturity date/day basis from calendar switch

DIS = days between issue date and settlement date

DIS/b = DIM/b − DSM/b

E = number of days in coupon period where settlement occurs

DSC = E − DIS = days from settlement date to next 6 month coupon date

N = number of semi-annual coupons payable between settlement date and maturity date or call date

$$\overline{\text{CPN}} = \frac{\text{CPN} \times \text{CALL}}{100}$$

DISC = discount rate (as a percent)

- Price on semi-annual coupon (given yield) with 6 months or less to maturity.

$$\text{PRICE} = \frac{100\left(\text{CALL} + \frac{\text{CPN}}{2}\right)}{100 + \left(\frac{\text{DSM}}{\text{E}} \times \frac{\text{YIELD}}{2}\right)} - \left[\frac{\text{DIS}}{\text{E}} \times \frac{\text{CPN}}{2}\right]$$

- Price on semi-annual coupon (given yield) with more than 6 months to maturity.

$$\text{PRICE} = \frac{\text{CALL}}{\left(1 + \frac{\text{YIELD}}{200}\right)^{\text{N}-1+\frac{\text{DSC}}{\text{E}}}} + \sum_{\text{K}=1}^{\text{N}} \frac{\frac{\text{CPN}}{2}}{\left(1 + \frac{\text{YIELD}}{2}\right)^{\text{K}-1+\frac{\text{DSC}}{\text{E}}}} - \left[\frac{\text{CPN}}{2} \times \frac{\text{DIS}}{\text{E}}\right]$$

- Price on interest at maturity note (given yield).

$$\text{PRICE} = \frac{100\left(\text{CALL} + \overline{\text{CPN}} \times \frac{\text{DIM}}{\text{b}}\right)}{\left(100 + \text{YIELD} \times \frac{\text{DSM}}{\text{b}}\right)} - \left(\overline{\text{CPN}} \times \frac{\text{DIS}}{\text{b}}\right)$$

- Price on discounted note (given discount rate).

$$\text{PRICE} = (\text{CALL}) - \left(\text{DISC} \times \text{CALL} \times \frac{\text{DSM}}{\text{b}}\right)$$

- Yield on discounted note (given price).

$$\text{YIELD} = \left(\frac{\text{CALL} - \text{PRICE}}{\text{PRICE}}\right)\left(\frac{\text{b}}{\text{DSM}}\right)(100)$$

Linear Regression

for

$$y = A + Bx$$

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

$$A = \bar{y} - B\bar{x}$$

where:

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

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

n = number of data pairs.

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Service Information

Must be **completed** and **returned** with your calculator, charger and batteries

Owner's Name _____ Date Purchased _____

Home Phone _____ Work Phone _____

Ship-to address for returning repaired calculator

_____

_____

Street Address _____ City _____ State _____ Zip _____

What Is The Problem Area?

- ☐ Intermittent Problem
- ☐ Printer Problem (**Enclose sample**)
- ☐ Keyboard Problem
- ☐ Display Problem
- ☐ Recharger Problem
- ☐ Battery Problem

Describe Problem: _____

_____

_____

Model No. _____ Serial No. _____

Preferred method of payment for out-of-warranty repairs. **If not specified, unit will be returned C.O.D.** ☐ BankAmericard ☐ Master Charge

Card No. _____ Expiration Date _____ Name appearing on credit card _____

☐ Purchase Order, companies with established Hewlett-Packard credit only. (Include copy of Purchase Order with shipment.)

Authorized Signature _____ P.O. Number _____

Service Card

Refer to the appendix of your Owner's Handbook to diagnose a calculator malfunction. The warranty period for your calculator is one year from date of purchase. Unless **Proof of Purchase** is enclosed (sales slip or validation) Hewlett-Packard will assume any unit over 12 months old is out of warranty. (**Proof of Purchase** will be returned with your calculator.) Should service be required, please return your calculator, charger, batteries and this card protectively packaged to avoid in-transit damage. Such damage is not covered under warranty.

Inside the U.S.A.

Complete the reverse side of this card and return items safely packaged directly to:

Hewlett-Packard
Corvallis Service Department
P.O. Box 999
Corvallis, Oregon 97330

We advise that you insure your calculator and use priority (AIR) mail for distances greater than 300 miles to minimize transit times. All units will be returned via priority mail.

Outside the U.S.A.

Where required please fill in the validation below and return your unit to the nearest designated Hewlett-Packard Sales and Service Office. Your warranty will be considered invalid if this completed card is not returned with the calculator.

Model No. Serial No. Date Received

Invoice No./Delivery Note No.

Sold By:

HP-92 Registration Card

Please complete and return this postage-paid card. This will enable us to send future product information to you.

Name _____
First Initial Last

Company _____
(Include Bldg., Division, Room No., etc.)

Street/Box/Route _____

City _____ State _____ Zip _____

Date Product Received Month ____ Day ____ Year ____

1. Where was your calculator purchased?

101 ☐ Directly from an HP sales office 102 ☐ By mail from HP 103 ☐ From any retail store

2. Check the one category best describing your job function.

201 ☐ Top Management
202 ☐ Middle Management/Supervisory
203 ☐ Professional/Technical
205 ☐ Other (Specify) _____

3. Rank two categories of applications for which your HP-92 will be used (1 for most important, 2 for second).

307 ☐ Financial Analysis/Financial Planning/Investment Analysis
308 ☐ Real Estate/Lending
309 ☐ Budgeting/Forecasting
310 ☐ Bonds/Notes
311 ☐ Accounting
312 ☐ Leasing
306 ☐ Statistics

If you are outside the United States:
- **Return this card in the enclosed warranty envelope.**
- **If no envelope, please mail this card to the nearest Hewlett-Packard sales and service office.**

Calculator Catalog and Buying Guide Request Card

Thank you for your order. Your friend or associate might also like to know about Hewlett-Packard calculators. If you would like us to send him/her the *new* **HEWLETT-PACKARD PERSONAL CALCULATOR DIGEST** *(the HP Magazine and Product Catalog)*, please write his/her name and address on this postage-paid Request Card.

Primary Interest: ☐ Scientific Calculators ☐ Business Calculators ☐ Fully-Programmable Calculators ☐ All

Name _____

Title _____

Company _____

Street _____

City _____ State _____ Zip _____

430J/ Valid in U.S. only

Please remove this portion before mailing.

FIRST CLASS

Permit No. 33

Corvallis, Oregon

BUSINESS REPLY MAIL

No postage stamp necessary if mailed in the United States

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Hewlett-Packard
1000 N.E. Circle Blvd.
Corvallis, Oregon 97330

FIRST CLASS

Permit No. 33

Corvallis, Oregon

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Hewlett-Packard
1000 N.E. Circle Blvd.
Corvallis, Oregon 97330

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

For additional Sales and Service Information contact your local Hewlett-Packard Sales Office or call 800/648-4711. (In Nevada call collect 702/323-2704.)

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