The Hewlett-Packard Personal Calculator
DIGEST

Programming: The way to grow!

HP Catalog begins on page 7!

5 new Series E Calculators listed!

When you step up to programming, step up to Hewlett-Packard.

Programming can be a quantum leap in your personal capabilities. And with the special advantages you get from HP, it can be a joy.

Step up to RPN.

It uses far fewer keystrokes than algebraic, especially for those longer problems. And RPN conserves program memory because you don't have to waste it on parentheses.

Step up to usable power.

An HP programmable uses only one line of memory for two or three keystrokes thus effectively doubling or tripling the amount of program memory you have to work with.

Step up to easy editing.

If you make a mistake or want to change your program in midstream, no problem with HP. You can single-step backward or forward, checking each step as you go, or on some models you can go directly to any location or label in your program.

Step up to Continuous Memory.

If you use one or two programs frequently, an HP calculator with Continuous Memory is a real time-saver. It saves any programs and data you've put in it, even when you switch the power off.

So you don't have to re-program each time you use it.

Step up to the "smart" card reader.

The magnetic card reader in the HP-67 and HP-97 lets you load the entire program memory, or selected portions, manually or under program control. You can also load data from all registers, or selected registers, onto a card.
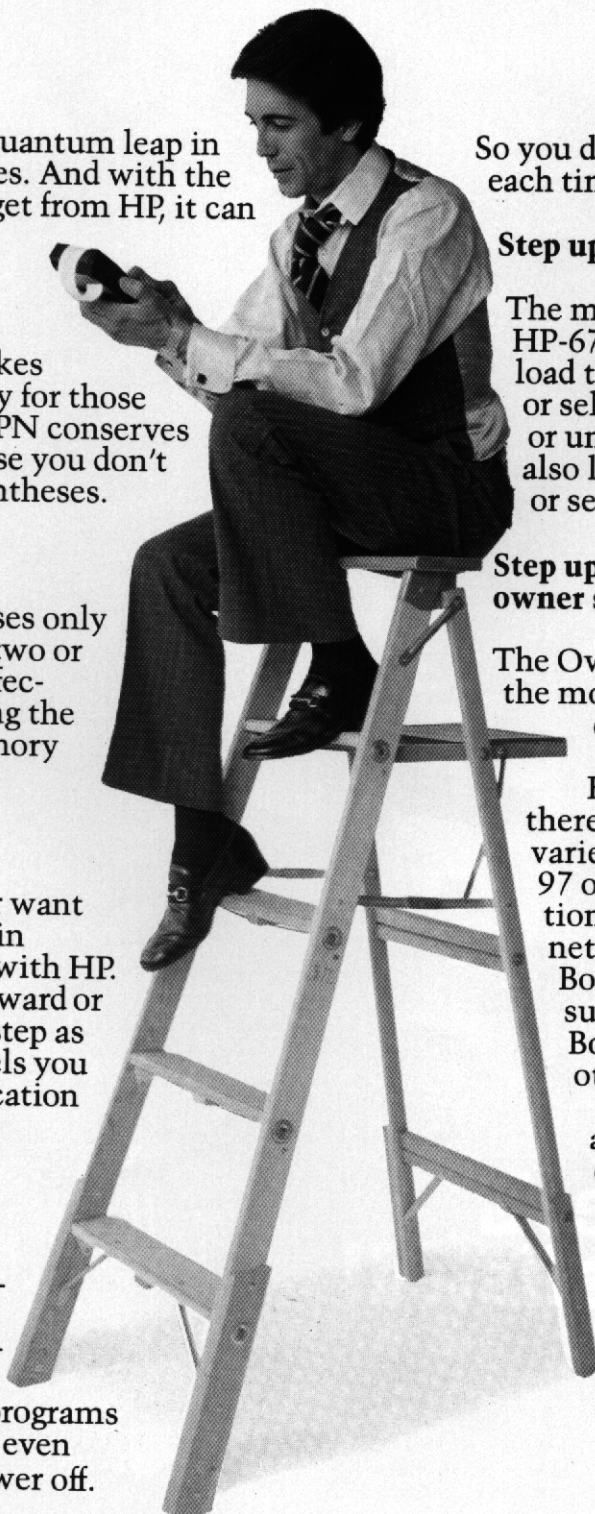
Step up to unparalleled owner support.

The Owner's Handbooks are among the most complete and helpful reference books ever published for personal calculators. For HP-19C/29C owners, there are 10 Solutions Books in a variety of disciplines. For HP-67/97 owners, there are 10 Application Pacs of prerecorded magnetic cards plus 40 Solutions Books and a Users' Library for subscribers. And Applications Books are available for most other HP calculators.

All HP programmables are fully described in the catalog section of this magazine. Order the one best suited to your needs, today.

HEWLETT hp PACKARD

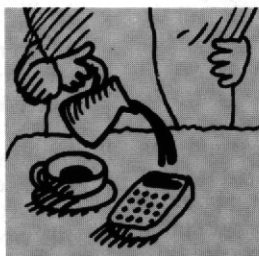# The Hewlett-Packard Personal Calculator

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Never Disappointed

While in graduate school I purchased an HP-22. Goodby forever to present value tables. Hello speed and accuracy. Most folks learn by doing, and with the HP-22 you can do a lot more "doing" per hour.

I am now in public accounting, and my machine continues to "crank on" almost daily. What is the current portion of this liability? How much interest was paid on this loan last year? What is the future value, at x%, of these two alternatives?

And I am patiently waiting for an HP printing calculator with both the functions of the HP-22 and the HP-80. Goodby clunky old ten key, hello HP-92?

> *Richard Klein*
> *Riverton, Wyoming*

After going through several calculators during the past 4 years, I finally had the good sense to buy an HP-21. The reliability, features and human engineering consistently prove its superiority even if others tout lower cost. I went that route and lost out to bouncing contacts, dim displays and useless features.

By the way, the spiral binding of the HP manuals allowing them to lay flat is worth its weight in gold!

> *Richard G. Nichols, Staff Eng.*
> *Vienna, Virginia*

I must say I enjoyed reading your latest HP Digest. Could you please send me the first and second volumes of the Digest (1977), and inform me how I may be put on the mailing list.

Indeed I've been a Hewlett-Packard fan for years, first an HP-45, then an HP-25, now an HP-67 and, needless to say, I've never been disappointed by Hewlett-Packard.

At school I know many students who have sold their previous calculators to buy Hewlett-Packard's. But I know of nobody who has ever sold their H.P. for a calculator manufactured by some other company. Keep up the good work!

> *Gary Irwin*
> *Erindale College,*
> *University of Toronto*
> *Mississauga, Ontario*

Editor's Note:
We are sorry but we cannot put international addresses on our mailing list. If you would like to receive future issues of the Digest please supply us with a U.S. address and write:
HP Digest
1000 N.E. Circle Blvd.
Corvallis, Oregon 97330
You may wish to contact your local HP representative from time to time to receive particular Digest issues.

The Natural Order of RPN

I would like to add my two cents to the RPN algebraic brouhaha as well. One of the more significant points is that algebraic notation is hardly "natural". As proof of this I point to Cajori's History of Algebraic Notations in which he shows that the current system of algebraic notation has had seven hundred years of development and was only finalized in the late 20's (at least in its current form in America by the American Society of Mathematicians) and my experience is that people, in general, still do not understand it. The notation is relatively obvious for someone who is trained to read the language but it is set down for the eye and logical manipulation: anyone who has done much computation would not approach calculation in such fashion. Specifically anyone who has had any experience with a large computer knows that computations must be translated into reverse Polish before they can be executed on a computer. All calculators use reverse Polish; it is just that very few give the operator the chance of handling reverse Polish directly rather than having the machine do it for you under the rubric of "natural" formulae. You have only to try an algebraic programmable to realize how backwards the language is.

> *Brian Fortier, FSA*
> *West Des Moines, Iowa*

I have nothing but praise for your calculators and the RPN logic system that you use. It is far superior to the algebraic logic system. The RPN system, with its automatic memory stack, really comes into its own in solving problems as they evolve from thought, such that a written equation is not before you. The fact that an operation is carried out on the entry in the display, and not necessarily on the result of all previous operations and entries, makes it possible to proceed with the solution of a problem in the order in which it evolves mentally, without the necessity of structuring the equation before beginning. Your calculators are thus ideal for solving problems while in conference.

> *William N. Tuller, B.E., M.S.*
> *New Orleans, Louisiana*

Those Amazing Programmables

This summer I worked for the Alaska Division of Aviation, building an airport in the remote Eskimo village of Ambler, 35 miles north of the Arctic Circle. My supervisor brought a fancy desk top calculator as part of the laboratory equipment, but a surge in the primitive village electricity system knocked it out in the first week. How would we do the lengthy calculations needed to figure out earthwork quantities?

Unbeknownst to my supervisor, I had already worked out the necessary programs for my HP-25C, so I made the computations with ease. After a few days my supervisor forgot all about repairing the desk top calculator; he shipped it back to Fairbanks, and the HP-25C carried the load for the entire season—not only for the earthwork computations but also for the soils work and surveying.

Even after spending some hundreds of hours with the HP-25C, I am amazed by the power and versatility of my little machine. I find it extremely enjoyable to devise new programs, and look forward to stepping up to a more advanced programmable next construction season.

> *Ole Wik*
> *Ambler, Alaska*

Your new products are truly exciting and I feel that you could sell a lot more programmables if you had a few articles telling what they can do for you. I purchased my first programmable after using one that I borrowed for a weekend, and I asked what can it do? Now I ask what can't it do as I am doing so much more with the one that I just purchased. I operate a small business and the card programmable really saves time and gives increased accuracy on the many jobs that I assign to it.

Keep up the great work and the new products and the high standard that you have established for yourself.

> *Charles L. Varble, Jr.*
> *St. Ann, MO*

Contribute to Digest: The Editor would be delighted to hear of any incident or experience you may have had with an HP calculator that would be of interest to our readers. Because of space limitations, not all letters received may be used and all letters are subject to editing. Please address your contributions to Editor, HP Digest, Hewlett-Packard Company, Corvallis Division, 1000 N.E. Circle Blvd., Corvallis, OR 97330, U.S.A.

Programming: The way to grow.

He had made up his mind once and for all. He was going to *do* it. He strides purposefully through the crowded store to the glittering display of calculators.

His head high, he approaches the woman behind the counter.

"I'd...I'd like to see something in a calculator." His throat goes dry. "A *programmable* calculator."

The woman smiles. "How much do you know about programming?"

His mind reels. He knows one thing. He knows it's *hard*. He thinks back to his college days, how long ago? Let's see...the Flying Finn, Paavo Nurmi, winning the marathon and the 5000 and 10,000 meter races in the Olympics. A table-model Philco with the sounds of the Modernaires singing *Goody Goody*. Yes, it's 1952...and he is in a cavernous room, gazing up at one of the world's first digital computers—a machine as big as a locomotive, its thousands of vacuum tubes aglow with an eerie light.

"One day," a professor explains, "computers like this one will free man from the drudgery of tiring, mathematical work just as the steam shovel freed him from the drudgery of physical labor."

A student raises his hand. "I've heard that, in some problem-solving situations, mathematicians using slide rules, and even abacuses, were able to beat the computer by a substantial margin. Any truth to that?"

The professor smiles weakly. "Yes, well...heh, heh. You see, before a problem can be solved on a computer, the problem must first be coded into instructions that the computer understands. The computer must be...ah...programmed. And 'programming' is a long and tedious process."

"Real drudgery, huh?"

"Yes, drudg...." The professor stops.

His mind reels on.

John Glenn orbits the earth. The Twist is suddenly the most popular dance in the country—and people don't even *touch* each other. That's right...it's 1962. And now there are seemingly hundreds of computers, each one with its own language. Should he learn SOAP, SHARE, or SCAT? FLIP, QUICK, or QUEASY? APT, SNAP, or UGLIAC? With over a hundred programming languages in use, what if he should study the wrong one?

"How much do you know about programming?" she had said.

"Uh—not much, I guess."

"Okay, then, what do you think is the most important consideration in choosing a programmable calculator?" she asks.

"Memory," he blurts. "The more memory, the better."

"Look, do you own a regular scientific calculator?"

"Of course," he says.

"Well, a programmable calculator is a lot like a scientific calculator—except that it can 'remember' a whole series of keyboard operations, and then execute them in order in a split second. With a programmable calculator you don't need any previous programming experience..."

Right up his alley!

"...because programmables don't use a 'language'—they use decimal mathematics, the same kind of decimal mathematics you're used to on your pocket calculator. Or in your high school algebra class. It's really super-easy!"

"Super easy?"

"Super-easy. Look, all you do is just slide this switch to *Write Program*. Then you press the keys in the same order you would to solve a problem. The calculator remembers these keystrokes." She presses a few keys. "There. Now I've entered a program to convert temperature in degrees Fahrenheit to Celsius."

"Celsius?"

"Same as centigrade. Now watch. We just slide this switch back to *Run*, key in the Fahrenheit temperature—let's say it's 35 degrees—and press a single key."

She presses a key, and a split second later the digits 1.67 appear in red lights in the display window.

"That's the answer," she says. "Thirty-five degrees Fahrenheit is the same as one point six-seven degrees Celsius. Uh, centigrade.

"So as you can see, one of the most important criteria for a programmable calculator is its utility as a *calculator*. You'll want a full range of scientific, mathematical, even statistical functions if you use them. And you'll probably want RPN."

"RPN?" Uh, oh. Here it comes. UGLIAC and QUEASY all over again. He tenses.

"Relax," she says. "RPN is just a way that some calculators solve a problem—a simple parenthesis-free method that, for the bulk of problems, will make programming easier and use fewer keystrokes."

"Well, what *about* the amount of memory?" he asks. "Isn't that important, too?"

"Of course. Generally, one keyboard operation is stored, or 'remembered', in one line of program memory. So the more program memory you have, the more operations you can store—and the longer and more powerful the programs you can write.

"But that's not the whole story. If you typically use only short- or medium-length programs, then you don't need the extra program memory offered in more expensive models of programmable calculators. And, of course, a calculator with RPN, since it's more efficient, keystroke-wise, than an algebraic calculator, makes better use of the program memory you do have.

"Another feature to look for is the merging of two or three keystrokes in a single line of memory. Some calculators, will let you place an instruction like STO + 2—where you're adding to the contents of storage register #2—in only a single line of program memory. Other calculators, though, can eat up as many as three lines of memory to record this same instruction. So you see that the *amount* of memory isn't as important as you might think—its *utility* and *efficiency* are also important."

"How do I know how much memory is right for me?"

"You'll get a pretty good idea by examining the 'program library' or the applications programs that come with the calculator. Compare the complexity of your own problems with the problems solved by the manufacturer-written programs. Few of the problems will actually be the same, but you can get a good idea of the type of problems the calculator can easily handle."

He examines one of the programmable calculators arrayed before him. "Aha," he says. "Here are STO and RCL keys for store and recall, just like on my scientific calculator."

"That brings up another factor that you should consider in buying a programmable," she says. "The amount of *data storage* that's available. This is quite different from the number of program lines a calculator can remember. In programming, even more than in a manually-operated calculation, it's often necessary to store a number away at one point, then recall it at another point. And that's where data storage registers come in."

Incredible. He has understood everything she's been telling him. Programming doesn't seem so difficult after all. But wait! He points to an unfamiliar key on one of the calculators.

"What's this? This GTO?" He used to own a Pontiac back in '66.

"Aha!" she exclaims."Now you've found one of the specialized functions that make a programmable calculator like this one so much more useful than merely a device that remembers keystrokes.

"That means *go to*. If a program is running and hits a GTO instruction, it goes to the part of the program selected by that *go to*. Look here..." She sketches quickly on a pad. "Say you have some program memory, and each line is identified by a number, like this.

```
 5
 6   GTO 9
 7
 8
 9
10
```
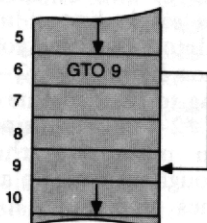
"Now, say a program is running along, ka-chunk, ka-chunk and hits a GTO 9 instruction. It immediately skips over all those intervening instructions in memory and resumes

again with the instruction in memory location #9.

"Of course, you can address a GTO instruction in many different ways. Sometimes it's done by memory location, as you see here. In other calculators, you might use a *label address*, where a portion of a program is given a label (like label A or label 5) and that is used as an address by GTO.

"*Go to* is not really so useful by itself," she continues, "but coupled with conditionals..."

"Conditionals?"

"Conditional instructions. These keys here." She points to the keyboard.

"X greater than Y? X unequal to Y?" he reads aloud.

"A conditional in your program lets the program make a decision, and then alter the path of the program based on the decision. Look here..." She begins drawing on the pad again.

```
 3
 4        x>y?
No  5     GTO 9        Yes
 6
 7
 8
 9
```
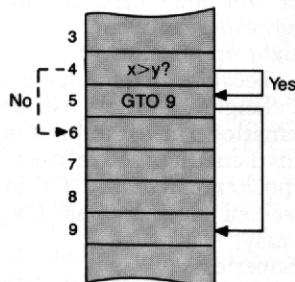
"... a conditional instruction works by asking a question—here the question is 'Is the number in X greater than the number in Y?' If the answer to the question is *yes*, the program continues with the next step of program memory. If the answer is *no*, the program skips a step before resuming. So if you just place a *go to* instruction as the next step after the conditional, like this, you can have the program make a decision."

"Can you give me a concrete example of how I might use a conditional?"

She pauses for a moment, then starts sketching again. "Look here. Suppose you have a checking account.

```
            Start
              |
    Enter amount of check
              |
            Is
No        balance        Yes
          below
          $300?
 |                        |
 |                 Subtract .15
 |                 from balance
 |                        |
    Subtract check from balance
              |
            Stop
```
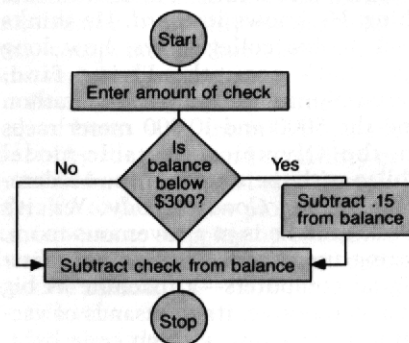
As long as your balance is $300 or more, you pay nothing for your checks. But as soon as your balance drops below $300, each check costs you 15¢ to write.

"In this program, you'd enter the amount of the check. Before the program processed that amount, though, it would ask the question 'Is the balance below $300?' If the answer is *no*, you can see that only the amount of the check is subtracted from your balance. But if your balance is below $300, and the answer to the question is *yes*, the program subtracts $0.15 from the balance before subtracting the check amount."

He is awestruck. It's so simple. He wants to race from the store with a calculator. He wants to start programming at last! He gropes for his checkbook.

"But, wait, there are other features of programmable calculators you should know about. Features like subroutines, for example.

"A subroutine is a section of a program that you identify with a *label* at the beginning and a *return*, which you'll usually see on the keyboard as RTN, at the end. If you have a section of code that you want to use at several places in the program, you can just define it as a subroutine, then call it up with a GSB, or *go to subroutine*,

instruction any time you want."
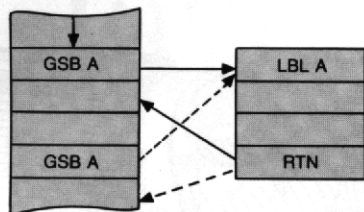
"Here the main program encounters the first GSB A instruction, and it goes out to the subroutine, executes downward until it encounters the RTN, and then returns to the main program and continues. Then later on, when it hits the second GSB A, it does the same thing. As you can see, having a subroutine capability on your calculator makes your programming much more efficient, because you can call one subroutine from many different places in a program.

"More sophisticated calculators have capabilities like flags, DSZ and ISZ, and indirect addressing. Flags are conditionals of a sort—a program tests a flag and makes a decision based on whether that flag is set or cleared. DSZ and ISZ mean 'decrement, skip on zero,' and 'increment, skip on zero.' They're valuable as counters in your programs. Indirect addressing lets you use a single index register as an address for instructions like *store* and *recall*—by changing the address in the index register, you change the object of the store or recall instruction.

"These probably don't mean much to you now, but believe me, they're sure useful. And when you're ready for them, you'll find a full explanation in your owner's handbook."

"What if I want to change a program, or find out that I've made a mistake? Do I have to erase the program from the calculator and start all over again?"

"Good heavens, no! Good programmable calculators have insert/delete editing. This means you move to the point in program memory that you want to modify and insert or delete instructions as required. Having some kind of indication in the display of where you are during editing is very important, and so is the ability to get to the desired point in memory.

"Most calculators have editing features like SST, with which you can *single-step* through a program until you come to the spot that you want to change. In the best programmables,

you can even execute a program one line at a time using this single-step function—you can monitor each operation of the program. A *back step* function—BST on the keyboard—is pretty important, too, since it lets you back up in program memory.

"Another really useful editing feature, and one that becomes more important as you get into calculators with a lot of memory, is being able to go to any point in a program immediately, without having to single-step all the way. So programmables like this one..." She held up a small handheld calculator, "...let you use the *go to* function to get to any location in the program memory, or, if you prefer, to any label.

"Program editing features are immensely important," she adds. "Because they're the interface between the programmer and his program."

"Gee, look at this one," he says. "Is this a *printer* on this little pocket-sized programmable calculator?"

"Sure is," she says. "Not everyone who programs will need a

printer, of course, but it's indispensible if you need a copy of masses of data and results. A printer is also a big help in the editing process, especially if it has the options either of listing every line of the program and its line number or of 'tracing' an executing program—that is, printing the input data, then the operation performed, then the next operation, then the result, and so forth on through the program. You can really examine your program with a fine-tooth comb that way!"

"Now, if I turn off one of these programmable calculators," he asks, "Is my program lost? Will I have to press all those keys again to reload it every time I want to run the program?"

"There are a number of options for saving your programs," she says. "If all of your programs are really short, you might just opt for something like this keystroke programmable calculator. It remembers programs of up to 49 lines, but on this one you *will* have to keep a listing of your keystrokes and reenter the program every time you turn the calculator off, then on again. However, its brother, here, has *Continuous Memory.* A calculator with Continuous Memory is a little more expensive, but it saves any programs and data that are in it, even though you turn the power switch off. Continuous Memory is particularly good if you have one or two programs you use all the time.

"When you get a calculator with over about a hundred lines of program memory, the problem of making a mistake when keying in a long program becomes more acute. So you'll probably want to go with one of the card-programmable calculators on the market. These actually remember your programs on small magnetic cards, each about the size of a stick of gum. When you want to load a different program into the calculator, you just pass a card through a special slot, and, zip, your program is there, ready to go."

Fear surges up in him again. "Is there any danger of...well, of *breaking* one of these? Or maybe getting it locked up in some kind of an endless loop?"

"You can always halt a running program with the press of a key," she says reassuringly. "As for things like reliability, quality of construction, and support, you should probably ask your colleagues and co-workers. I'm sure many of them have programmable calculators already."

Boy, *do* they! And he is more determined than ever not to miss the programming bandwagon.

"When you buy a programmable calculator," she continues, "you'll want to consider three main points: Program capacity—how much do I need? Program retention—how will I save my programs? And printing—is it a requirement?

"Your programmable should have some useful applications programs accompanying it, so you can begin using it right away. But eventually you'll want to program it yourself. Not merely because programming will solve *your* everyday problems in *your* discipline, in a fraction of the normal time. No, not even because you'll be solving *new* problems, forging new solutions, expanding your mathematical horizons by leaps and bounds. No, you *will* be doing all of this, but that's not the real reason you'll want to program."

Now she speaks rapidly. "Do you know *why* you want to program?"

He shakes his head. He hasn't the faintest idea.

"For the sheer *joy* of programming!" she cries triumphantly. "The joy of the parent, the artist, the craftsman.

"You take a program, born weak and impotent as a dimly-realized solution. You nurture the program and guide it down the right path, building, watching it grow ever stronger. Sometimes you paint with tiny strokes, a keystroke added here, a keystroke changed there." She sweeps her arm in a wide arc. "And other times you savage whole *blocks* of code, ripping out the program's very *essence*, then beginning anew. But always building, creating, filling the program with your own personal stamp, your own quirks and nuances. Watching the program grow stronger, patching it when it crashes, until finally it can stand alone—proud, powerful, and perfect. This is the programmer's finest hour!"

Dimly at first, then louder, he hears the strains of a Sousa march. Humming, he signs his personal check and places it on the counter. She thrusts his new programmable calculator into his outstretched hand.

"This...this is your canvas! Your clay! Go forth and create a masterwork!"

Holding his programmable calculator high, he marches from the store—yes, marches—with 30-inch strides. He *will* be a programmer!

Beyond the Call of Duty.
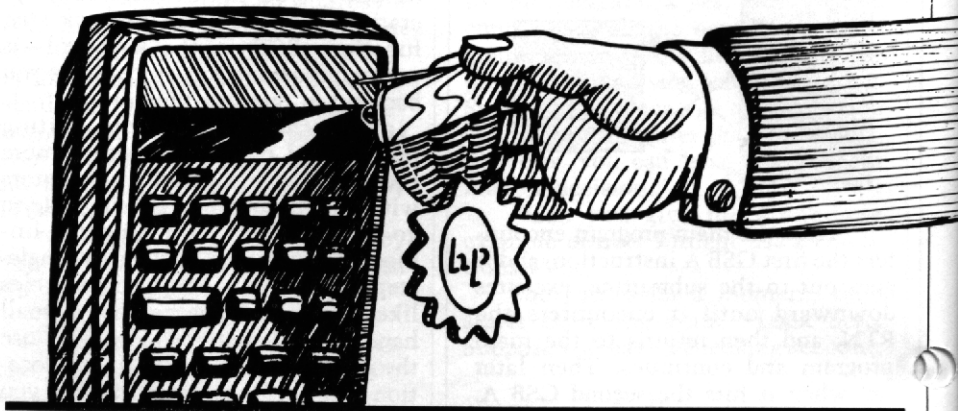
I would like to bring to your attention a small incident which happened with my HP-65.

On January 5, when rushing out of the office, I put my HP-65 in my pocket—without its case which I lost a long time ago. In Bierset, I parked my car in a very muddy road. After getting out of the car I bent down to fold up my trousers because of the mud—± 16 cm—due to work being conducted there. Upon getting home I noticed I did not have my HP-65 anymore. On January 6, I called the police and several local authorities, after having of course searched my car, and at noon I went to check where I had parked the day before. I found the HP-65 completely buried in the mud, probably because of cars going over it since there were more than 50 of them due to a charter coming back. The ground was frozen and I had to use a hammer and a pick to dig out a block of mud with the HP-65 inside. I let it dry and in the evening I vigorously brushed the machine off. The big problem was the blocking of the card entry. I had to feed in cards for approximately 1 hour blowing into the machine after each process and finally it is now in working condition again. It records, charges normally. Unfortunately, some sand still remains inside and comes out after each use (between keys, under the battery).

The above is certainly not a treatment which should be recommended and is probably more wearing than being put into orbit or sent to the moon as I think has been done with the HP-65.

M. Legrand
Golettes, 4
4860 Pepinster
Belgium

I would like to tell you a story about my HP-25. I was doing some calculating with it on the vinyl top of my Dodge at Citizens Electronics in San Diego and forgot I left it sitting on top of the car, and drove off. Well, it stayed on the top very securely until I-5 northbound and off it went.

My heart dropped too—seeing it unprotected, bouncing all over the freeway and like a fool, I pulled off to the shoulder and "figured" (which is very difficult without my H.P.) it at least deserved a better funeral than I-5.

Anyway the DAMN thing worked. And it's been 10 months and it still is doing a great job, scratched, bruised and mistreated, but still operating.

I'm going to treat myself to an HP-19C for Xmas and send my HP-25 to Ripleys. Anyway keep up the quality. HP is the Rolls Royce of calculators.

V/R M. Klipp
US Navy
Fleet Training Group
ASW Base
San Diego, CA 92147

The 1978 Hewlett-Packard Catalog and Buyer's Guide to Personal Calculators

The Buyer's Guide: Pages 8-9

This guide helps you select the calculator that is right for the work you do by discussing the six basic categories of HP calculators: general purpose, preprogrammed financial, preprogrammed scientific, keystroke programmable scientific, keystroke programmable financial, and fully-programmable scientific and financial.

The Catalog: Pages 10-27

The catalog provides a description of each HP Personal Calculator with emphasis on its special capabilities and applications in meeting your requirements. Also given are physical specifications and accessories and software furnished with each unit.

Comparison Chart: Pages 28-29

This chart lists every feature and function found in all HP Personal Calculators. You will find the list extremely useful in determining specific features and functions on any unit and for making fast direct comparisons of two or more units.

How to order from this catalog:

You may order any HP Calculator in this catalog by contacting your nearest HP sales office or distributor. For the name of the office nearest you, write Hewlett-Packard Company. Regional addresses appear on the back cover of this magazine.

Calculator displays in all photography simulate typical appearance.

Buyer's Guide

General Purpose.

Almost any of the four-function calculators available today will do an adequate job of addition, subtraction, multiplication and division. However, for professional people who frequently perform arithmetical computations, the ideal handheld calculator is one that will provide all the features of standard desktop office machines. If you require a printed record of your calculations and the dependability of high-quality engineering and construction, you should take a close look at this calculator:

HP-10
Handheld Printing.   Page **14**.

Preprogrammed Financial.

Many business people are significantly extending their professional capabilities by switching from simple four-function calculators to advanced calculators. The preprogrammed calculator is an ideal step up, even for people whose skills in math and statistics are rusty or altogether lacking. With a few simple keystrokes, the preprogrammed calculator provides fast and accurate solutions to a wide range of financial and statistical problems, many involving complex computations. If you are interested in the advantages of a preprogrammed financial calculator, you should study the data on these two instruments:

HP-37E
Business Management.   Page **10**.

HP-92 Investor.   Page **12**.

Preprogrammed Scientific.

A preprogrammed calculator is the first advanced instrument many engineers and scientists use, and it is ideal for those whose work does not often require complex or repetitive computations. It is also often an ideal choice for engineering students who want to shorten the time required for problem solving. If you are interested in a preprogrammed scientific, you should look at the data on these two calculators:

HP-31E Scientific.   Page **15**.

HP-32E
Advanced Scientific with Statistics. Page **16**.

HP-37E

HP-10

HP-92

HP-31E

HP-32E

**How to select the
right calculator for
the work you do.**

Selecting the right calculator is no longer a simple matter of equating functions, features and cost. With the wide range of advanced instruments available today, proper selection now depends largely on a careful analysis of your professional needs and—most important—your personal growth. Indeed, the selection of a calculator you feel may be somewhat in advance of your current needs can significantly speed your growth by expanding your problem-solving capabilities. The information below should make it easy for you to select the HP calculator that will do the best possible job for you.

Keystroke Programmable Scientific.

The keystroke programmable is invaluable for those who frequently deal with complex or repetitive scientific computations. A keystroke programmable can solve these problems automatically when it is programmed to do so. Then, all you have to do is key in your data and let the calculator run the entire computation. For those who use a few programs frequently, the Continuous Memory feature may be especially useful. This feature makes it possible to retain programs and data even with the calculator switched off. If keystroke programming sounds logical for you, look at the information on these three calculators.

HP-33E
Programmable Scientific.   Page 17.

HP-19C
Advanced Printing Programmable with Continuous Memory.   Page 18.

HP-29C
Advanced Programmable with Continuous Memory.   Page 19.

Keystroke Programmable Financial.

The financial keystroke programmable is ideal for managers, financial analysts and consultants because it offers two basic methods of problem solving. Most everyday time and money problems can be solved using the wide variety of built-in functions. For more complex and repetitive financial computations keystroke programming is particularly helpful. With keystroke programming you can save hours of time wasted in long, tedious calculation. And once a program is written into the calculator, there is no possibility of human error. If keystroke programming sounds logical for you, look at the information on this calculator.

HP-38E
Advanced Financial with Program-mability.   Page 11.

Fully-Programmable Scientific & Financial.
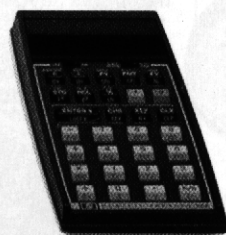
The fully-programmable is the most powerful, flexible and comprehensive of all advanced calculators. Complex programs can be stored permanently on small magnetic cards and used in the calculator over and over again. Pre-recorded program cards are available for a number of areas such as business, math, statistics, medicine, physical science, life science and many others. If you are looking for a calculator that will provide you with maximum capability, check the data on these two instruments:

HP-67
Fully-Programmable.   Page 20.

HP-97
Fully-Programmable Printing.   Page 21.

HP-19C

HP-67

HP-33E   HP-29C

HP-38E   HP-97

HP-37E New!

Business Management Calculator.

Provides an ideal combination of the financial, investment, and statistical capabilities you need in modern business.

In the tradition of the popular HP-22, Hewlett-Packard's new HP-37 is the basic calculator you need for answers to most business and financial problems such as pricing, compound interest, and trend lines. With expanded financial capabilities, valuable percent and statistical functions, and a new straightforward way of solving financial problems, the HP-37 is the ideal calculator for real estate brokers, managers, bankers, accountants, students, or people in business and management.

A New Generation of Calculators.

The HP-37 is a Hewlett-Packard Series E calculator designed to give you more functions and more ease-of-use features, at a lower price than any comparable calculator we've ever offered. It features:

- New simple and intuitive financial problem solving system.
- New easy-to-read display automatically separates thousands just as you would yourself.
- New exclusive built-in calculator test capability— and display codes to guide you in correcting your errors.
- Traditional Hewlett-Packard attention to detail.

Simple, Complete Financial Functions.

In time and money problems, all you need do is key in any three or four of the values for n (number of compounding periods), i (interest rate), PV (present value), FV (future value), and PMT (payment)—in any order—followed by the appropriate financial key. Then press the key to solve for the unknown value.

And if you want to change one of those values, you can do it with a single keystroke. Ordinary or annuity due problems can also be directly calculated at the flip of a switch. The HP-37's ability to modify the variables in a problem continuously makes it ideal for those "what if?" situations so common in business.

Easy-to-Use Cash flow Sign Convention.

With the HP-37 you can state any financial problem in a simple, intuitive manner, so you don't have to remember handbook instructions. Problems are entered in terms of cash flows. Cash outflows are negative and cash inflows are positive, both when you enter data and when you display results. With this system you can easily solve complex problems such as the yield of a loan with a balloon, the payment on a lease with a buy back option.

Amortization Schedules.

The HP-37 calculates an amortization schedule (the accumulated interest, amount paid toward principal, and the remaining balance) for any number of time periods.

Retail-Style Percent Functions.

Whether you're solving for percent, percent change or percent of total, you'll appreciate the logical, consistent operation of the HP-37.

And the unique new PRICE function calculates the selling price if you know the cost and margin.

Seven User's Storage Registers.

Besides the five financial registers and the Hewlett-Packard four-register automatic memory stack, the HP-37 is equipped with seven other memories, in which you can store or recall constants, answers, or any number you want to save during your calculations.

Statistics at Your Fingertips.

For research and analysis, the HP-37 is packed with useful statistical functions. The Σ+ key automatically accumulates the values needed to calculate the means (averages) and standard deviations for two different sets of data. A factorial function is also available.

The HP-37 also provides a linear regression, or trend line, function and can compute correlation coefficient.

Physical Specifications:

- Length: 140 mm (5.6")
- Width: 75 mm (3.0")
- Height: 30 mm (1.2")
- Weight: 220 g (7.7 oz)

For a complete list of features and functions, see the Comparison Chart on pp. 28-29.

The HP-37E Business Management Calculator comes complete with:

- *HP-37E Owner's Handbook*
- *Your HP Financial Calculator: an introduction to financial concepts and problem solving.*
- *Investment Analysis and Statistics Applications*, a valuable applications book for business professionals and students. (*Real Estate Applications* and *Lending, Savings and Leasing Applications* are also available as optional accessories.
- Recharger/AC adapter.
- Rechargeable battery pack.
- Soft carrying case.

Orders accepted beginning July 1, 1978.
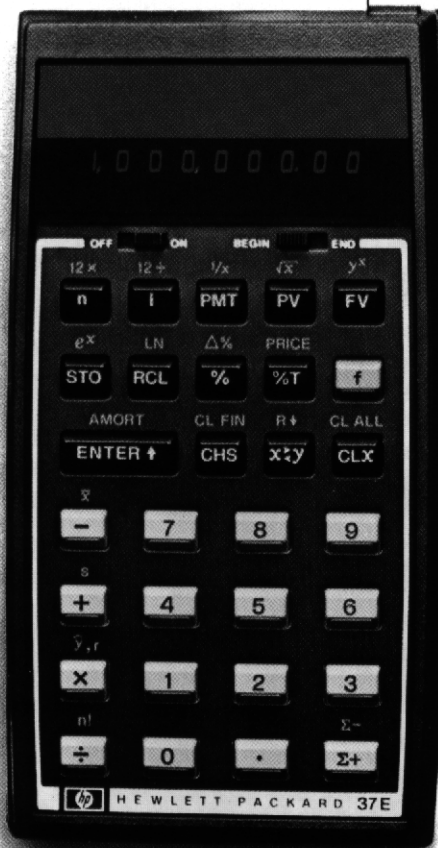
HP-38E New!

Advanced Financial Calculator with Programmability.

An unparalleled array of built-in financial functions— plus the added value of personal programming.

The new HP-38 is a powerful financial calculator with the ability to "remember" all the keystrokes in a calculation and to repeat them over and over again at the touch of a key. It provides capabilities that are invaluable to managers, financial analysts and consultants, commercial real estate agents, and advanced business students.

A New Generation of Calculators.

The HP-38 is a Hewlett-Packard Series E calculator which gives you the same new features found in the HP-37.

Powerful Cash Flow Analysis.

The HP-38 calculates net present value (NPV) and internal rate of return (IRR) for up to 20 uneven cash flows, or for 20 groups of uneven cash flows with up to 99 cash flows in each group (a maximum of 1980 cash flows). NPV and IRR let you weigh a leasing situation against buying, balance the worth of an investment against desired yield, or compare investment alternatives.

Easy Time-and-Money Calculations.

The HP-38 offers all the financial capability of the HP-37. In addition, the HP-38 computes simple interest with the INT key.

Easy, Instant Programming.

The HP-38 is so easy to use you'll be writing programs in minutes! With the calculator switched to Program mode with the P/R (Program/Run) key, it doesn't execute the keystrokes but instead remembers them as you press them in order.

To run the program, just switch back to Run mode with the P/R key, key in your data, and press R/S (Run/Stop). Every time you press R/S, the HP-38 executes the entire sequence of keystrokes in seconds.

It's that easy!

By programming the HP-38, you can save hours of time wasted in long, tedious calculation. And once that program is written into the calculator, there is no possibility of human error.

Double-Duty Memory.

The HP-38 shares its memory space between program memory and data memory. When the HP-38 is first turned on, it contains 8 lines of memory for your program and 20 addressable storage registers. As you write a program longer than 8 lines, memory is automatically converted from data storage to program memory (at a ratio of 1 to 7) until you've reached a maximum of 99 lines, with 7 storage registers remaining inviolate. And remember, any keyboard operation occupies one line of program memory even though it may take one, two or three keystrokes to perform.

A Handy 2000-Year Calendar.

The built-in HP-38 calendar can easily calculate the actual number of days between two dates on a 360- or 365-day calendar basis, day of the week, or a future or past date.

Statistics at the Press of a Key.

The HP-38 offers all the statistical capability of the HP-37 plus linear estimate of x for a known y and $\bar{x}_w$ (weighted average).

Physical Specifications:

- Length: 140 mm (5.6")
- Width: 75 mm (3.0")
- Height: 30 mm (1.2")
- Weight: 220 g (7.7 oz)

For a complete list of features and functions, see the Comparison Chart on pp. 28-29.

The HP-38E Advanced Financial Calculator with Programmability comes complete with:

- *HP-38E Owner's Handbook and Programming Guide.*
- *Your HP Financial Calculator.*
- *HP-38E Quick Reference Card.*
- *Investment Analysis and Statistics Applications,* a valuable applications book for business professionals and students. *(Real Estate Applications* and *Lending, Savings and Leasing Applications* are also available as optional accessories.)
- Recharger/AC adapter
- Rechargeable battery pack
- Soft carrying case

Orders accepted beginning May 1, 1978.
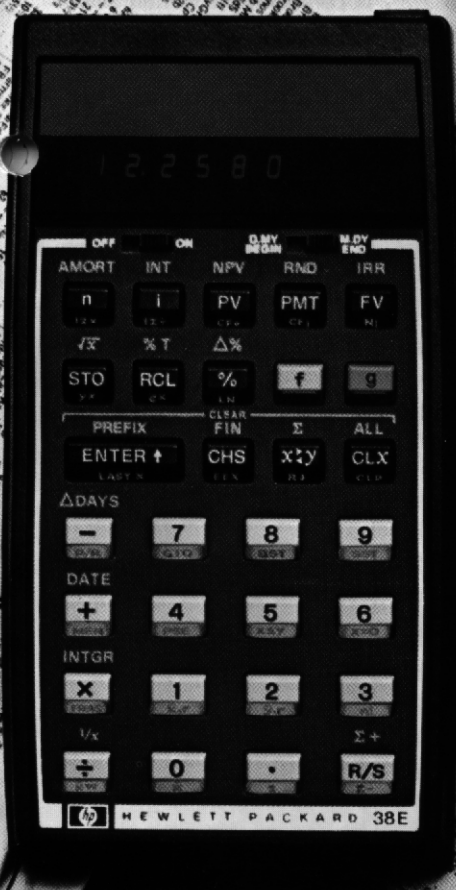
HP-92 Investor

Offers solutions for the professional in finance.

The HP-92 Investor is a personal-sized financial calculator that offers preprogrammed solutions for institutional investors, financial consultants, real estate analysts, loan officers, leasing salesmen, accountants and other professionals examining investment alternatives.

The HP-92 Investor solves problems involving time and money. Compound interest. Balloons. Internal rate of return for 30 uneven cash flows. Net present value. Bonds and notes. Three kinds of depreciation.

Invaluable printer gives you a complete record.

The quiet printer on the HP-92 gives you the answers quickly and quietly—with descriptive labels. Whether duplicating your keystrokes, printing amortization and depreciation schedules, or listing all the cash flows in an IRR problem, the HP-92 Investor gives you that indispensable hard copy for instant analysis or later perusal.

Easy-to-use cash flow sign convention.

The HP-92 Investor is remarkably easy to use. An important new design lets you state any problem in a simple, intuitive manner, so you don't have to remember handbook instructions. Problems are entered in terms of cash flows. Cash outflows are negative and cash inflows are positive, both when you enter data and when you display results. Whether your profession calls it a mortgage with a balloon payment or a lease with a buy back (or residual), it's the same thing to the HP-92—and you can easily solve it.

Compact and portable.

The HP-92 Investor is so small that it takes up only a corner of your desk or fits in your briefcase, ready to produce those investment answers you need—any time.

And the HP-92 is completely portable. You can operate it from its rechargeable batteries or from a convenient AC outlet.

Financial Functions That Solve Real-World Problems.

n **i** **PV** **FV** **PMT**

The HP-92 Investor solves complicated "real-world" problems involving compound interest, residuals and salvages, partial payments and balloons, wraparound mortgages, even internal rates of return based upon uneven cash flows.

All you need to do is key in any three or four of the values for n (number of compounding periods), i (interest rate), PV (present value), FV (future value) and PMT (payment)—in any order—followed by the appropriate financial key. Then press the key to solve for the unknown value.

If you know n or i, you can solve any problem which can be represented by an initial value, a series of payments, and a final value—or by any two of these.

Easy Comparison of Investment Alternatives.

If you want to change any of the parameters of a financial problem, you merely key in a new value and press the appropriate key; then press any other financial key to see the effect of the change—without restating the entire problem each time.

And, because it can list the latest values for all financial elements at your command, the HP-92 Investor lets you print every investment alternative, whether for immediate comparison or later examination.

Discounted Cash Flow Analysis for 30 Uneven Cash Flows.

NPV IRR

The HP-92 Investor calculates the net present value (NPV) and the internal rate of return (IRR) for up to 30 uneven cash flows. So you can evaluate whether to lease or buy equipment, balance the worth of an investment with uneven cash flows against desired yield, or compare investment alternatives based on their net present value.

Once the cash flows have been entered into the HP-92, you can change one or any number of them without restating the complete problem.

Amortization Schedules at the Press of a Key.

AMORT
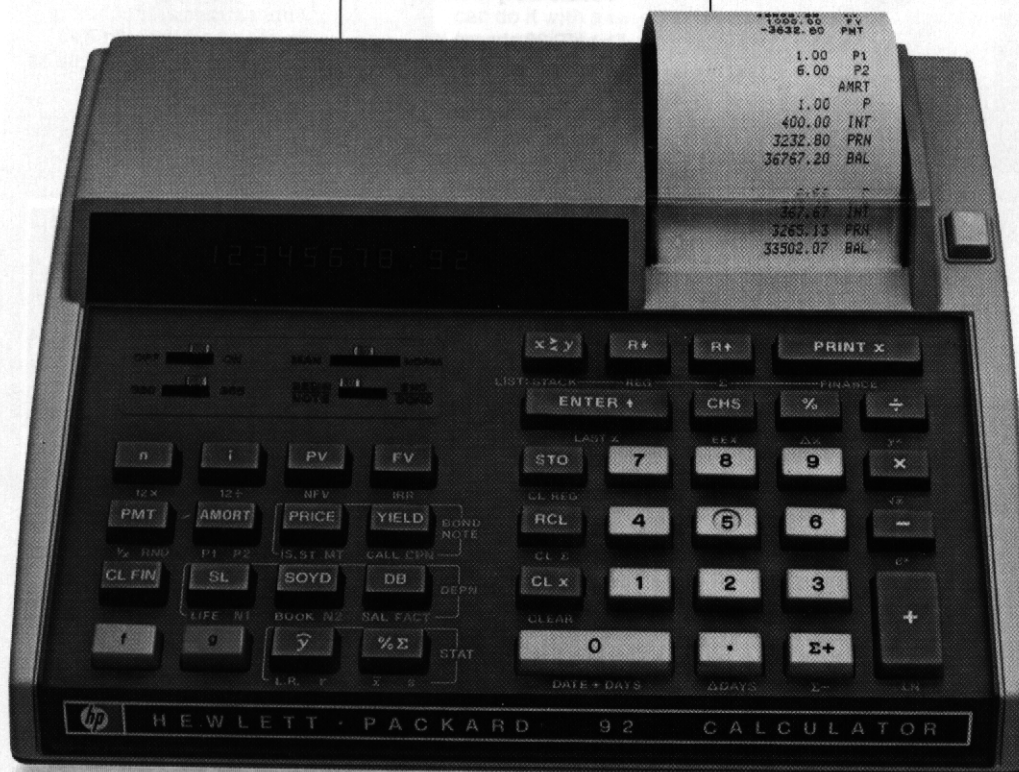
The HP-92 Investor can print a complete amortization schedule, showing each period of a fully amortized loan with the amount paid to interest, amount to principal, and the remaining balance. Or it can print a partial schedule between any two periods. Labels identify each element of the schedule, and after the last period, the schedule shows the total amount paid to both interest and principal as well as the remaining balance on the loan.

Bond and Note Computations— Quickly and Accurately.

PRICE YIELD

CALL CPN

The HP-92 Investor calculates price, yield, or accumulated interest on bills, notes, bonds, certificates, debentures, warrants, certificates of deposit, and other interest-bearing obligations—and the HP-92 meets the standards for accuracy demanded by the Securities Industry Association.

Useful Percent Functions.

% Δ%

The HP-92 gives you the most useful percent functions: Percent, Percent of Sum, and Percent of Change.

Three Kinds of Depreciation Schedules.

SL SOYD DB LIFE

BOOK FACT SAL

Using the HP-92 Investor, you can quickly and easily compute depreciation using the straight line, sum-of-the-years' digits, or declining balance method and you can solve for the crossover. The HP-92 can print a complete

	DB
1.00	N
1512.45	DPN
6049.78	RDV
2.00	N
1209.96	DPN
4839.82	RDV
3.00	N
967.96	DPN
3871.86	RDV

depreciation schedule for the entire life of an asset, or it can calculate the depreciation allowance for a specific period.

And once you've keyed in such elements as an asset's initial (book) value or its salvage value, you can examine each type of depreciation with a single keystroke—and compare all types of depreciation without reentering data.

Powerful Statistical Functions.

r x̄

The HP-92 Investor contains statistical functions for research and analysis. Both linear and non-linear trends can be closely examined, and mathematic models can be generated to make forecasts.

A Built-in Calendar.

DATE+DAYS △DAYS

The calendar functions of the HP-92 Investor can determine a future or past date given the number of days from a known date. It also will print the day of the week for any date, and it calculates the exact number of days between dates.

30 Storage Registers For Data.

STO RCL

Besides the four-register operational stack used for mathematical operations, the HP-92 Investor has 30 addressable storage registers for data storage and recall—with storage register arithmetic on 10 registers.

Common Math Functions.

The HP-92 Investor provides the most common mathematical functions like logarithms, square root, and exponentials.

Physical Specifications

- Calculator width: 22.9 cm (9.0")
- Calculator length: 20.3 cm (8.0")
- Calculator height: 6.35 cm (2.5")
- Calculator weight: 1.13 kg (40 oz)
- Recharger/AC adapter weight: 170 gm (6 oz)
- Shipping weight: 2.7 kg (5.9 lb)

Temperature Specifications

- Operating temperature range: 0° to 45°C (32°F to 113°F) with paper, 5% to 95% relative humidity.
- Charging temperature range: 15° to 40°C (59° to 104°F).
- Storage temperature range: −40° to +55°C (−40° to +131°F).

Power Specifications

- AC Power Requirements: 90-120V or 220V ± 10%, 50 to 60 Hz.
- Battery: 5.0 Vdc nickel-cadmium rechargeable battery pack.
- Battery operating time: 3 to 7 hours.
- Battery recharging time: Calculator off, 7 to 10 hours; calculator on, 17 hours.

For a complete list of features and functions, see the Comparison Chart on pages 28-29.

The HP-92 Investor comes complete with:

- Rechargeable battery pack
- Recharger/AC adapter
- Soft carrying case
- Illustrated Owner's Handbook
- Applications Book
- Two rolls of thermal paper
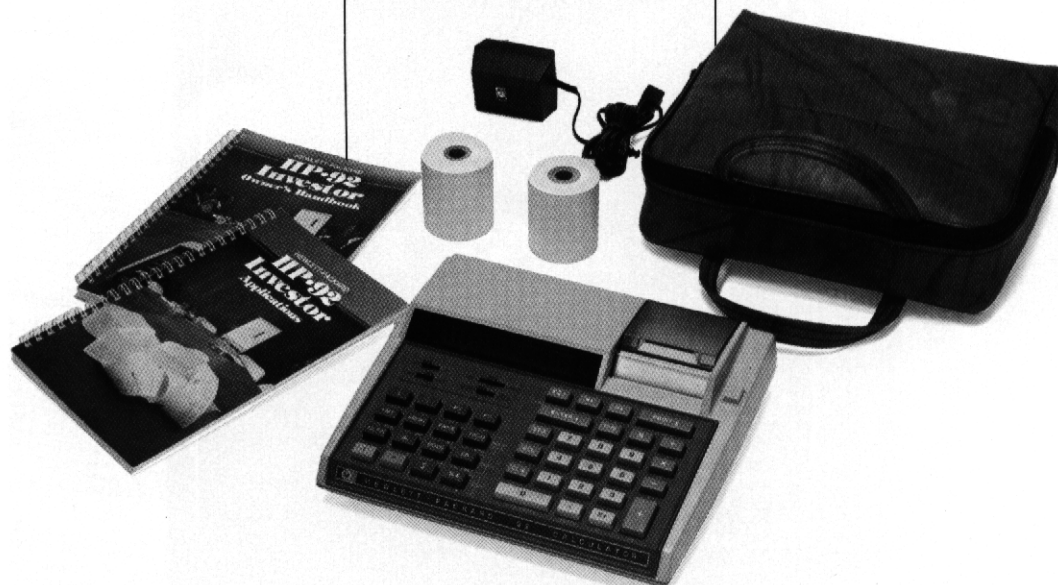
HP-10

Handheld Printing Calculator

All the features of a desktop office machine—and it's pocket-sized.

Hewlett-Packard's exciting new HP-10 is up to 50% smaller and lighter than other handheld printing calculators—with all the features you'd expect to find in a desktop office machine.

Whisper-quiet thermal printer.

The HP-10 Printing Calculator gives you a printed record of all your calculations. Each function is printed with an identifying label so it's easy to see what you've done.

You can also print a display entry (to label your tapes) without including it in your total and a series of crosshatches to separate problems on the tape.

Or you can switch the printer off and use only the display.

All the functions you need.

State-of-the-art electronics and integrated circuitry have reduced the standard office machine to pocket-size—and still improved it. You get an independent memory, so a constant or separate running total is available at the press of a single key, and you don't have to reenter results in long calculations.

You also get the "add-mode" feature, which automatically positions the decimal point for keying in dollars and cents.

And you get a percent key for taxes, dividends and commissions, a total and subtotal capability, and of course, the four arithmetic keys.

Use it anywhere.

The powerful rechargeable batteries in the HP-10 let you use it

anywhere—in an automobile, a taxi, or a commuter train. Stylish and unobtrusive in your office or on your desk, its small size and light weight also make it ideal for pocket or briefcase.

Office machine conveniences.

Familiar adding-machine keyboard has "click-action" keys for positive input, and is buffered so the calculator will "catch up" when you key in numbers very rapidly.

Ten clear, sharp digits are displayed for viewing in dim or bright light.

Physical Specifications:

- Length: 16.5 cm (6.5")
- Width: 8.8 cm (3.45")
- Height: 4.0 cm (1.6")
- Weight with battery pack and paper: 342 g (12.1 oz)

- Shipping weight: 1.18 kg (2.6 lb)
- Operating temperature range: 0° to 45°C (32° to 113°F) With paper, 5% to 95% relative humidity.
- AC Power requirements: 90-120V or 220V ± 10%, 50 to 60 Hz Battery: 5-volt quick-charge nickel-cadmium battery pack.

For a complete list of features and functions, see the Comparison Chart on pages 28-29.

The HP-10 Handheld Printing Calculator comes complete with:

- Battery pack that under normal use provides 4-7 hours operating time and fully charges in 6 to 10 hours.
- Recharger/AC adapter
- Illustrated Owner's Handbook
- Soft carrying case
- Three rolls of thermal paper (7.6 m each)
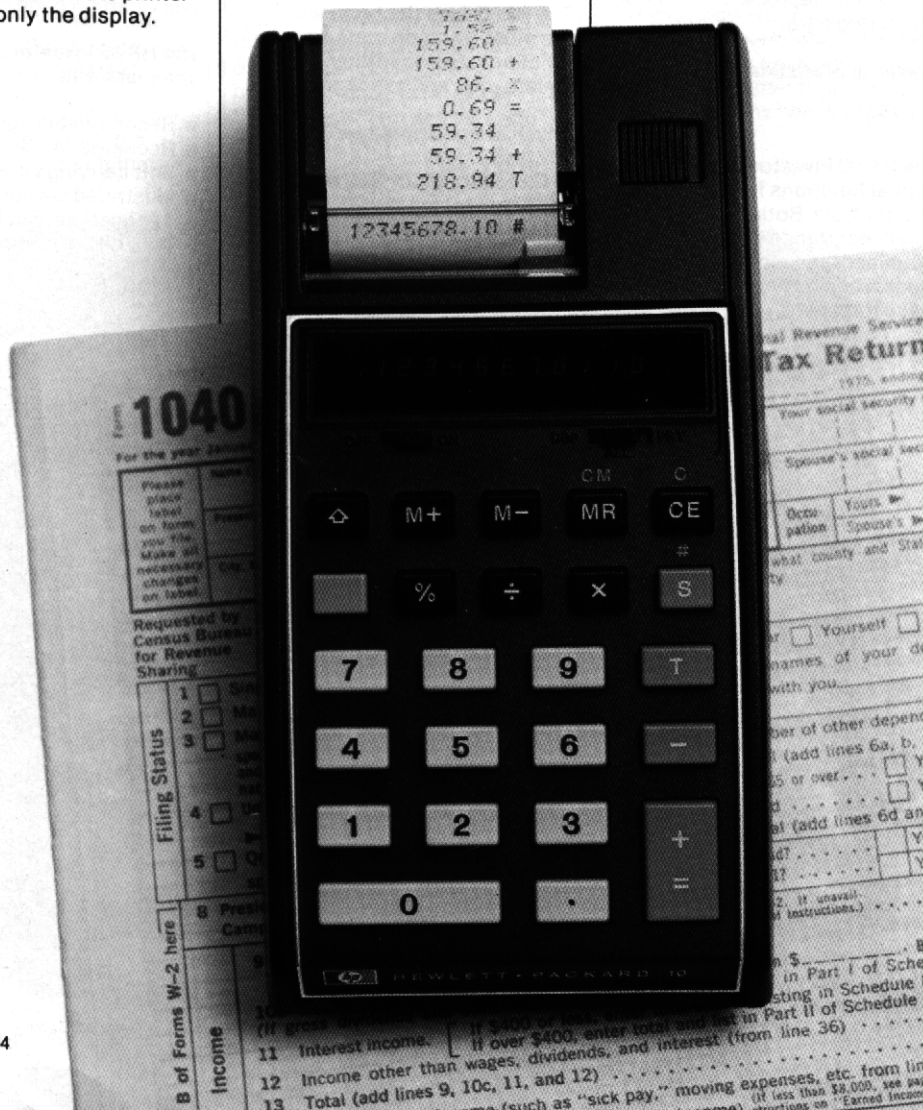
HP-31E New!

Scientific Calculator.

Gives you an excellent blend of mathematical and scientific functions at a very low price.

The HP-31 has been designed in the tradition of the famed HP-35 and the popular HP-21 calculators—a basic no-nonsense machine to slice through the toughest scientific and mathematical problems with ease. And the HP-31 Scientific Calculator has great new features, together with an unparalleled combination of keyboard and display functions.

A New Generation of Calculators.

The HP-31 is a Hewlett-Packard Series E calculator designed to give you more calculating power, more ease-of-use features, at a lower price than any comparable calculator we've ever offered. It features:

- New easy-to-read display, automatically separates thousands just as you would yourself.
- New exclusive self-check capability, error codes and improved accuracy.
- Time proven RPN.
- Traditional Hewlett-Packard attention to detail.

Mathematical Functions.

The HP-31 has the functions you need for science or engineering. Exponentials, reciprocals, square roots, pi, and percent, all available at the press of a key. And of course, the HP-31 adds, subtracts, multiplies and divides—all with 10-digit accuracy.

Trigonometric Capability.

The HP-31 quickly and accurately computes sine, cosine, or tangent—all with a choice of decimal degrees, radians, or grads mode. And you can convert directly between degrees and radians, too.

Rectangular/Polar Conversions.

The HP-31 converts directly between rectangular coordinates (x,y) and polar coordinates (magnitude r, angle Θ).

Logarithms.

Common and natural logarithms, as well as antilogarithms, are generated at the touch of a key by the HP-31.

Metric Conversions.

The HP-31 gives you instant, two-keystroke conversions between inches and millimeters, Fahrenheit and Centigrade, and pounds and kilograms.

Four Addressable Registers and LAST X.

Besides the four-register automatic memory stack, the HP-31 contains four *addressable* storage registers for selectively storing and recalling constants, results, or other data.
And the HP-31's LAST X register automatically stores the last value present before any calculation.

Two Display Modes.

A choice of two display modes—fixed or scientific—lets you view any number as either a full, 10-digit (or less) mantissa or as a mantissa of up to seven digits followed by a two-digit exponent of 10. No matter what display you've selected, the HP-31 internally maintains full 10-digit accuracy—and you can see the full 10-digit mantissa at any time by simply pressing the MANT key.

Selective Clearing Options.

You can clear the entire calculator, clear only the storage registers, or clear only the automatic memory stack.

Physical Specifications.

- Length: 140 mm (5.6")
- Width: 75 mm (3.0")
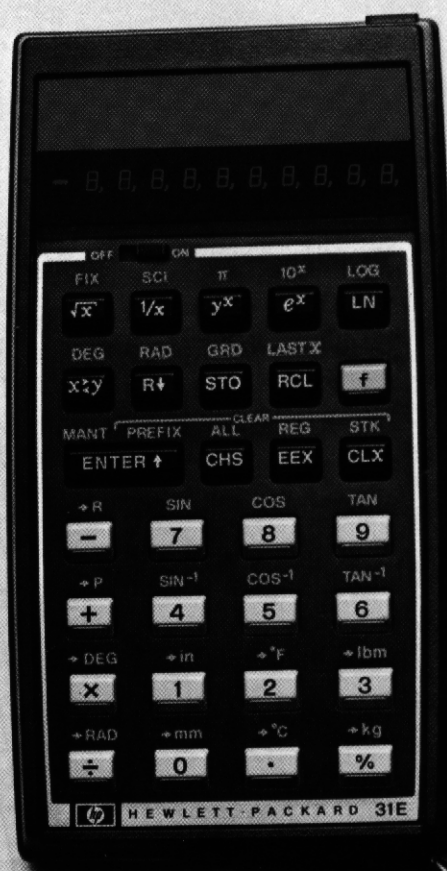- Height: 30 mm (1.2")
- Weight: 220 g (7.7 oz)

For a complete list of features and functions, see the Comparison Chart on pp. 28-29.

The HP-31E Scientific Calculator comes complete with:

- *HP-31E Owner's Handbook*
- *Solving Problems With Your Hewlett-Packard Calculator*
- Recharger/AC adapter
- Rechargeable battery pack
- Soft carrying case

Orders accepted beginning May 1, 1978.

HP-32E New!

Advanced Scientific Calculator with Statistics.

Gives you a powerful set of mathematical and statistical functions plus 15 addressable storage registers.

Hewlett-Packard's new HP-32 is the most powerful scientific preprogrammed calculator we've ever built. Like the classic HP-45, the HP-32 is packed with dozens of invaluable mathematical and scientific functions. But that's not all! The HP-32 has more addressable storage registers and increased statistical capability which creates an advanced scientific calculator that puts unparalleled power at your fingertips.

A New Generation of Calculators.

The HP-32 is a Hewlett-Packard Series E calculator designed to give you more calculating power, more ease-of-use features, at a lower price than any comparable calculator we've ever offered. It features:

- New easy-to-read display automatically separates thousands just as you would yourself.
- New exclusive self-check capability, error codes and improved accuracy.
- Time-proven RPN.
- Traditional Hewlett-Packard attention to detail.

Superior Statistics.

For the manager, the statistician, or anyone who must reduce and interpret data, the HP-32 gives you features never before offered on a Hewlett-Packard pocket calculator.

Normal Distribution.

The HP-32 is equipped with the normal and inverse normal distribution functions—it can compute the area under a standard normal distribution curve to the left of x, and it can also compute x given the area under the curve.

Two-Variable Means and Standard Deviations.

At the press of a key you can calculate the means of two variables. And the HP-32 can also give you the sample standard deviations of those two sets of data.

Linear Regression and Linear Estimate.

The HP-32 calculator easily computes linear regression, calculating the slope and y-intercept of a least-squares line for data. And you can also calculate the correlation coefficient to measure for "goodness of fit." In addition, the HP-32 linear estimate function can actually predict new values along the line.

Data Accumulation and Correction.

$\Sigma+$ automatically accumulates Σx, Σy, Σxy, Σx^2, and Σy^2 in designated storage registers. Correcting a data pair is easy, too, with $\Sigma-$.

15 Addressable Storage Registers.

To help you store and recall data, results, constants, or statistical information, the HP-32 is equipped with 15 addressable storage registers. And you can perform arithmetic on the contents of any of them.

The HP-32 also has a LAST X register which automatically preserved the contents of the display present before the last operation.

Trigonometric Functions Including Hyperbolics.

Besides providing sine, cosine, and tangent and their inverses, the HP-32 also computes hyperbolic trigonometric functions (sinh, cosh, tanh, and their inverses).

Rectangular/Polar Conversions and Vector Arithmetic.

The HP-32 quickly converts rectangular coordinates (x,y) to polar coordinates (r,Θ), or vice versa. And vector arithmetic is easy using the rectangular/polar functions with the accumulation functions $\Sigma+$ and $\Sigma-$.

Three Display Modes.

The large numbers in the bright red LED display can be seen in fixed, scientific, or engineering mode (in engineering mode the exponent of 10 is always a multiple of three). You can always see the full 10-digit mantissa, regardless of display mode, by pressing the MANT key.

Physical Specifications.

- Length: 140 mm (5.6")
- Width: 75 mm (3.0")
- Height: 30 mm (1.2")
- Weight: 220 g (7.7 oz)

For a complete list of features and functions, see the Comparison Chart on pp. 28-29.

The HP-32E Advanced Scientific Calculator with Statistics comes complete with:

- HP-32E Owner's Handbook
- Solving Problems with Your Hewlett-Packard Calculator.
- Recharger/AC adapter.
- Rechargeable battery pack.
- Soft carrying case.

Orders accepted beginning July 1, 1978.

HP-33E New!

Programmable Scientific Calculator.

Extraordinary problem-solving power plus versatile keystroke programmability to solve repetitive problems quickly and easily.

Like its famous predecessor the popular HP-25, the new HP-33 remembers a series of keystrokes as you press them, then executes the sequence later at your command. And this ability extends the usefulness of its powerful combination of scientific functions and features.

A New Generation of Calculators.

The HP-33E is a Hewlett-Packard Series E calculator designed to give you more calculating power, more ease-of-use features, at a lower price than any comparable calculator we've ever offered. It features:

- New easy-to-read display, automatically separates thousands just as you would yourself.
- New exclusive self-check capability, error codes, and improved accuracy.
- Time-proven RPN.
- Traditional Hewlett-Packard attention to detail.

Programming is Easy.

Programming the HP-33 is simple—just switch to PRGM and press a problem-solving series of keystrokes to be remembered by the calculator. Then switch to RUN, key in any known data, and hit the R/S (run/stop) key. The HP-33 does the rest, executing those keystrokes in a few seconds, over and over as many times as you like. There's no complicated programming language to learn, no elaborate "start-up" procedures to memorize.

49 Lines of Program Memory.

The HP-33 remembers your program in a special memory—49 lines of it. And no matter whether a keyboard operation is one, two or three keystrokes, it occupies only a single line of memory, so you can easily load programs of 100 keystrokes or more.

More Programming Features.

Besides 49 lines of fully-merged program memory, the HP-33 has a variety of specialized functions to make your programming useful, powerful, and even fun.

Go To.

The GTO (go to) command transfers an executing program to a specified line of memory—permitting you to create branches and loops in your programs.
    And for editing, you can also use GTO from the keyboard to go to any line number.

Powerful Decision-Making Capability.

Fundamental to the operation of even the largest computer is its ability to make a decision. The HP-33 has eight conditionals which actually compare two values and make a decision based on the outcome of the comparison.

Three Levels of Subroutines.

Using the GSB (go to subroutine) instruction, you can save memory and make your programs much more efficient. After a section of memory has been called up as a subroutine, a RTN (return) instruction then returns execution to the next line after the GSB call.

Fast, Easy Editing.

Besides being able to go to any line number with GTO, you can also use SST and BST to single-step or back-step through a program, *without* execution, to any point you want in program memory. Changing a program is easy, too—you just key in a new instruction and it automatically replaces the old one.

Pause.

The PAUSE function in a program actually lets you see a result or an intermediate answer for a second before resuming execution.

Eight Addressable Storage Registers.

In addition to the 49-line program memory, the four-register stack and the LAST X register the HP-33 has 8 addressable storage registers for data. And you can perform storage register arithmetic on these addressable registers, too.

Optional Applications Books

The solutions you require may already exist in the four applications books available for the HP-33. Subjects covered include mathematics, statistics, surveying, and student engineering. For a complete listing, refer to Accessories on pages 26-27.

Physical Specifications.

- Length: 140 mm (5.6″)
- Width: 75 mm (3.0″)
- Height: 30 mm (1.2″)
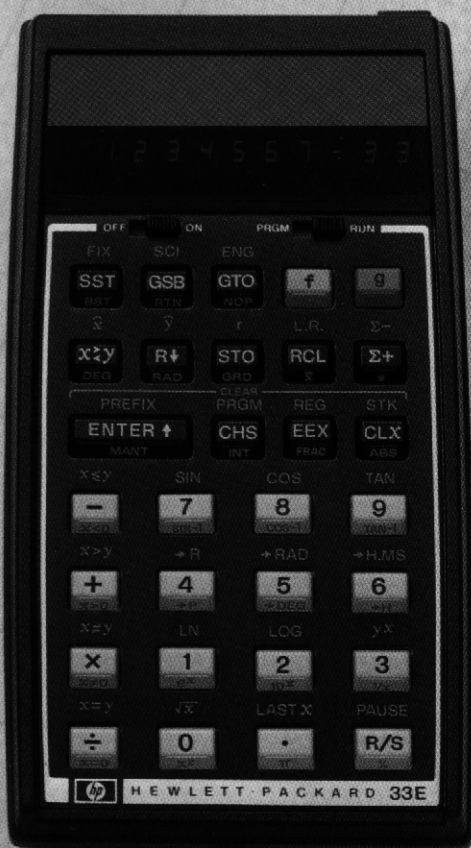- Weight: 220 g (7.7 oz)

For a complete list of features and functions, see the Comparison Chart on pp. 28-29.

The HP-33E Programmable Scientific Calculator comes complete with:

- HP-33E Owner's Handbook.
- Solving Problems With Your Hewlett-Packard Calculator.
- HP-33E Quick Reference Card.
- Recharger/AC adapter.
- Soft carrying case.

Orders accepted beginning May 1, 1978.

HP-19C

Advanced Printing Programmable Calculator with Continuous Memory.

On or off, your programs are always there.

The HP-19C and HP-29C both have Continuous Memory capability so the programs you store are saved, ready for use, until you clear or overwrite them.

As a result you can program frequently-needed calculations once, and then perform them as often as necessary—hour after hour, day after day—without bother or lost time caused by reentering your program.

The Continuous Memory of the HP-19C and HP-29C not only retains a program, it also retains the data stored in 16 of its 30 addressable registers and the display register.

Now you can record data in the field and wait to make your final calculations until convenient. The calculators become handy notebooks to save data from previous programs for later use or keep the sum of statistical data entries while taking samples on location.

Operate them on batteries or AC.

Both calculators may be operated on batteries alone or from a convenient electrical outlet while batteries are being recharged.

Battery operating time is significantly extended since the calculators may be switched off between calculations without losing programs or data.

HP-19C's quiet thermal printer lists your programs or data.

With the HP-19C, you can list a program, the contents of the 30 addressable registers, or the contents of the automatic memory stack. And you have a complete record of all your calculations.

The printer is a valuable aid in editing programs or long calculations. You don't have to remember what you've done or what remains to be done. You see everything at once, clearly, on tape.

Create programs of 175 keystrokes—or more.

You can create your own time-saving programs to solve lengthy and repetitive problems because both the HP-19C and HP-29C let you merge keystrokes. Each function—one, two, three or four keystrokes—requires only one line of program memory. And you have 98 lines of program memory to work with.

The HP-19C and HP-29C are keystroke programmable. This means that when you press a key in PRGM mode, it is stored in program memory. There is no complicated programming language, no procedure to memorize.

Branching.

GTO Go To.

When followed by a label designator (0 through 9 or i) GTO branches program execution to the specified label.

Three levels of subroutines.

GSB Go Subroutine.

A GSB instruction followed by a label designator (0 through 9 or i) branches program execution to the label specified just as a GTO instruction does. But, using the GSB instruction, program execution is then "returned" automatically to the step following the GSB instruction when the next RTN (Return) instruction is executed.

Conditional Branching.

$$\boxed{x \neq y} \cdot \boxed{x = y} \cdot \boxed{x \leq y} \cdot \boxed{x > y}$$
$$\boxed{x \neq 0} \cdot \boxed{x = 0} \cdot \boxed{x < 0} \cdot \boxed{x > 0}$$

These keys allow your programs to make decisions for you by testing the values in the X- and Y-registers or by testing the value in the X- register against zero as indicated. If the data test is true, the calculator will "do" the next instruction in program memory. (Remember "Do if True") If the data test is false, program execution branches around the next instruction.
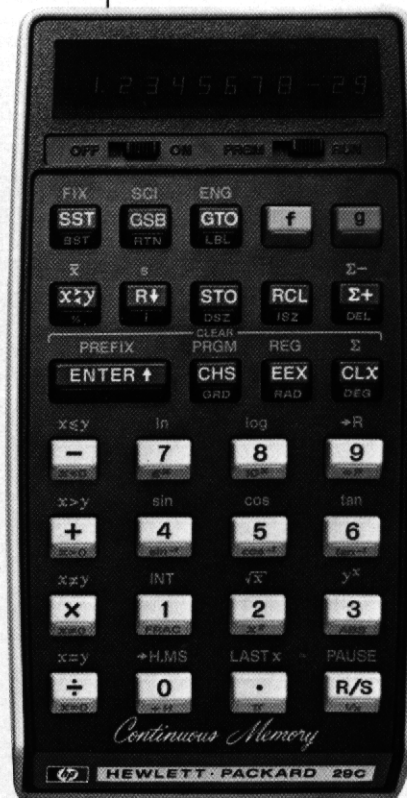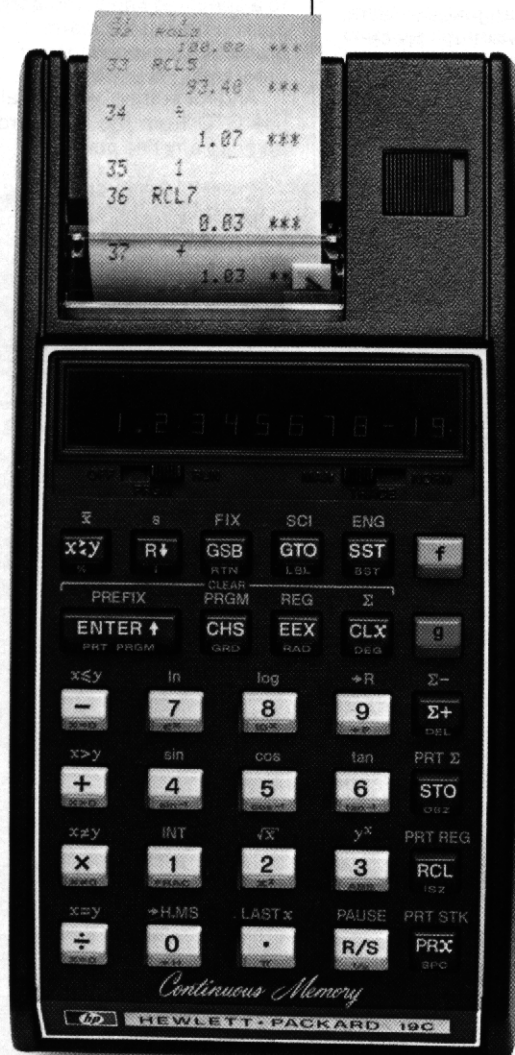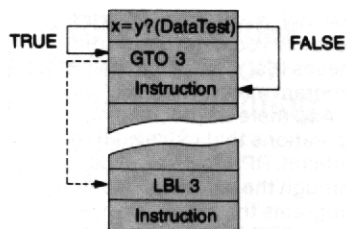
The next line is executed if x = y. Program execution branches around one line if x does not equal y.

Indirect Addressing.

GTO **i** **GSB** **i**

These operations depend on the number in register 0. If it is positive they perform a branch (GTO i) or a subroutine (GSB i) to the label specified.

Relative Addressing.

GTO **i** **GSB** **i**

When the number in register 0 is a negative number, these instructions perform a rapid reverse branch (GTO i) or subroutine (BSB i) the number of lines specified by the current negative number in register 0.

Indirect control of Data Register Operations.

You can also use register 0 to specify the address of a storage register for storing and recalling data or for storage register arithmetic.

Decrement or Increment and Skip on Zero.

DSZ **ISZ**

DSZ subtracts one from the contents of register 0, then tests for a non-zero value. As long as there is a non-zero value in register 0, the calculator performs the next instruction in program memory. When the content of register 0 equals zero, the calculator skips the next instruction.

ISZ works the same way, only register 0 is incremented rather than decremented.

PAUSE

The PAUSE function interrupts program execution and displays current results for about 1 second.

Moving to the Right Step.

GTO Go To.

In order to correct or change a line in your program, you need to be able to display it quickly and easily. Pressing GTO (line number) lets you do just that, in either RUN or PGRM mode.

SST Single Step.

To help find mistakes in your program, you can execute it one line at a time using the SST key in RUN mode. Or, in PRGM mode, you can use SST to step through each instruction and compare the keycodes with your program listing.

BST Back Step.

In the RUN mode, press BST to display the contents of the previous line of program memory. In PRGM mode, use BST to back up one line at a time in your program.

Insert and Delete.

You can easily insert operations as needed in your program. All subsequent instructions will be "bumped" down one line in program memory for each inserted operation.

DEL Delete.

When you press g DEL, the displayed instruction is erased from program memory and all subsequent instructions move upward one line.

A complete range of preprogrammed functions and features.

The HP-19C and HP-29C feature 30 addressable registers for data storage—16 with Continuous Memory.

Their preprogrammed functions include log and trig functions; rectangular/polar conversions; mean, standard deviation and statistical summations; and angle (time) conversions.

Both calculators also display in fixed decimal, scientific and engineering notations.

Ten new Solutions Books for HP-19C/29C.

The solution you require may already exist in one of the ten new Solutions Books Hewlett-Packard has written for the HP-19C/29C.

Each book contains 10 to 15 programs and covers a variety of disciplines including business, engineering, mathematics, medicine, statistics, physical science, life science and other subjects. For a complete listing, refer to page 27 under Accessories.

These programs save you valuable time because no researching, programming, debugging or documenting is needed.

The HP-19C and HP-29C come complete with:

- Illustrated Owner's Handbook and Programming Guide

- Quick Reference Card
- Applications Book
- Battery Pack
- Recharger/AC adapter
- Soft carrying case
- 2 rolls of thermal paper (HP-19C only)

HP-19C Specifications:

- Calculator length: 165 mm (6.5″).
- Calculator width: 88 mm (3.45″).
- Calculator height: 40 mm (1.6″).
- Calculator weight, with battery pack and paper: 350 g (12.4 oz).
- Shipping weight: 1.4 kg (3.0 lbs).
- Operating temperature range: 0° to 45°C (32° to 113°F). With paper, 5% to 95% relative humidity.
- Charging temperature range: 15° to 40°C (59° to 104°F).
- AC Power requirements: 90-120V or 220V ± 10%, 50 to 60 Hz.
- Battery: 5 Vdc, quick-charge nickel-cadmium battery pack.
- Battery operating time: 4 to 7 hours.
- Paper roll length: 7.6 m (25 ft.)

HP-29C Physical Specifications:

- Calculator length: 130 mm (5.1″)
- Calculator width: 68 mm (2.7″)
- Calculator height: 30 mm (1.2″)
- Calculator weight: 170 g (6 oz.)
- Recharger weight: 141 g (5 oz.)
- Shipping weight: 680 g (1.5 lb)
- Operating temperature range: 0°C to 45°C (32°F to 113°F)
- Charging temperature range: 15°C to 40°C (59°F to 104°F)
- Storage temperature range: −40°C to 55°C (−40°F to 131°F)
- Power requirements: AC: 115V or 230V ± 10%, 50 to 60 Hz
- Battery: 2.5 Vdc quick-charge nickel-cadmium battery pack.
- Battery operating time: up to 3 hours in normal use.

For a complete list of features and functions, see the Comparison Chart on pages 28-29.

HP-67

Fully-Programmable Pocket Calculator.

A major leap forward in fully-programmable personal calculators.

These are the most powerful personal calculators Hewlett-Packard has ever made. The HP-97 combines exceptional programming power—plus a battery-operated printer—all in one self-contained unit. The HP-67 provides the identical power of the HP-97 in the classic pocket size.

Exceptional power easily handles your lengthy, repetitive problems.

The HP-97/67 lets you write programs of up to 224 lines. Every function (one, two or three keystrokes) is merged to take only one line of program memory. And there are 26 data storage registers to provide the memory you need for your problems. You can record the contents of either program memory or the data storage registers on a magnetic card. Later, you can load all or part of them back into the calculator. The "smart" card reader of the HP-97/67 can handle either job. The HP-67 and HP-97 are also completely compatible. Programs recorded on one unit may be loaded and executed on the other.

So easy to use you'll write programs the first day.

Keystroke programming makes programming the HP-97/67 as simple as pressing the keys needed to calculate answers manually. Merged operations further simplify the task (and expand memory power) by letting you see the complete operation right in the display.

Because many programs require editing of some kind, we added useful features enabling you to easily review programs forward or backward, to easily jump to any line in the program, and to easily insert lines or delete them. RPN logic and the four-register automatic memory stack combine for more efficient problem solving. And RPN logic also helps when you program, because you don't use parentheses that waste valuable program memory.

And there are no pending operations that make editing difficult. RPN lets you slide through the most complicated programs the same easy way it lets you slide through complex calculations—with complete confidence.

An unparalleled program of owner support.

You can supplement your own programs with the extensive HP program library. The Standard Application Pac, with 15 programs in various disciplines, comes free with either calculator.

To get a better idea of the capabilities of the HP-67 and HP-97 in relation to your own needs, take the time to review the programs listed in the HP Application Pacs and Solutions Books. In many cases one of our professionally programmed and documented solutions may already exist to solve your problem.

Also available are a one-year subscription to the User's Library and a free Newsletter to keep you abreast of current information.

The HP-97 provides battery-operation and thermal printing —in one self-contained unit.
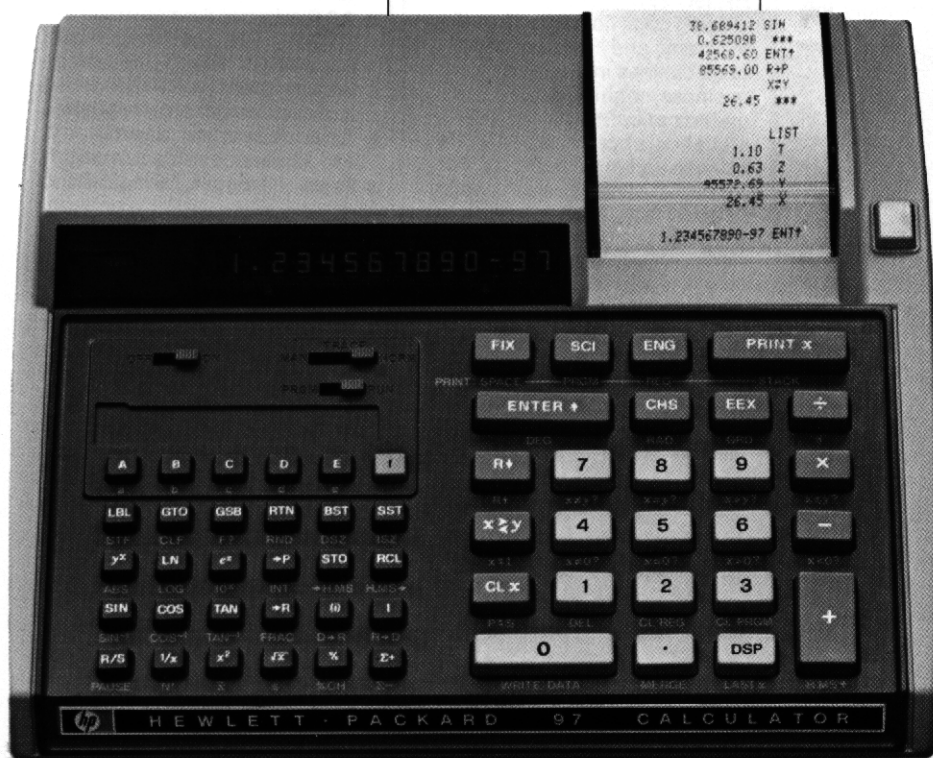
The new HP-97 Fully-Programmable Printing Calculator combines exceptional programming power and the great usefulness of a quiet thermal printer. What's more, the HP-97 operates on batteries as well as AC—so you can have a printed record whenever and wherever you need it. In addition, there's an extra-large display for easy readability and a buffered keyboard so data may be keyed in at high speed.

Quiet thermal printer lists your programs on tape for checking and editing.

With the HP-97, you can list a program, (line number, key mnemonic and, optionally, the keycode), contents of the automatic memory stack, or the contents of the data storage registers. And you have three printing modes to choose from.

The printer is a valuable aid in editing programs or long calculations. You don't have to remember what you've done or what remains to be done. You see everything at once clearly, on tape.

Compact in design and light in weight for easy portability.

Total weight of the HP-97 without AC adapter/recharger is only 1.13 kg. (2½ pounds). It's so small it will fit into a standard briefcase so you can take it with you, and operate it in airplanes, taxis, anywhere. For security, a built-in metal tab lets you secure it to your desk easily with a cable or bolt.

The HP-97 and HP-67 give you exceptional programming power you won't outgrow.

"Smart" magnetic card reader.

With the magnetic card reader in both the HP-97 and the HP-67

you can load the entire program memory, or selected portions, either manually or under program control.

You can record data from all registers onto a magnetic card. You can also load every data storage register or selected registers.

When recording programs, the HP-97 and HP-67 automatically record the angular mode setting, the display setting and the status of the four flags.

10 User-definable Keys.

There are ten user-definable keys you can use for any special function you may require—such as defining portions of your program for subroutines or branches. In addition, there are ten numerical labels (LBL 0 thru LBL 9).

GTO **GSB**

You can perform a direct branch or subroutine to a label specified.

A GSB instruction can also be used within a subroutine to a depth of three levels.

Conditional Branching.

x≠y · **x=y** · **x≤y** · **x>y** ·

x≠0 · **x=0** · **x<0** · **x>0**

These keys allow your program to make decisions for you by testing the values in the X- and Y-registers or by testing the value in the X-register against zero as indicated.

Flags.

You can use the four flags in the calculator for tests in your programs. They can be set, cleared, or tested.

Indirect Addressing.

GTO **(i)** **GSB** **(i)**

You can perform a direct branch or subroutine to a label specified by the current positive number in the I-register using these keys. When the number in the I-register is a negative number these instructions perform a

direct branch (GTO (i)) or a subroutine (GSB (i)) backward the number of lines specified.

STO **(i)** **RCL** **(i)**

You can also use the I-register to specify the address of a storage register for storing and recalling data or for storage register arithmetic.

ISZ **(i)** **DSZ** **(i)**

You can also increment (ISZ (i)) or decrement (DSZ (i)) the contents of the storage register specified by the value in the I-register and then test against zero.

HP-97 Specifications:

- Calculator width: 228 mm (9")
- Calculator depth: 203 mm (8")
- Calculator height: 63 mm (2.5")
- Calculator weight: 1.13 kg - (2.5 lb)
- Recharger weight: 268 g (9.5 oz)
- Shipping weight: 4.3 kg (9.5 lb)
- Paper temperature range 10°C to 40°C (50°F to 104°F)
- AC Power Requirement: 90-120V or 220V ± 10%, 50 to 60 Hz
- Battery Power Requirement: 5.0 Vdc nickel cadmium rechargeable battery pack

HP-67 Specifications:

- Calculator length: 152.4 mm (6")
- Calculator width: 81 mm (3.2")
- Calculator height: 18 to 34 mm (0.7 to 1.4")
- Calculator weight: 298 g (10.5 oz)
- Recharger weight: 241 g (8.5 oz)

- Shipping weight: 2.3 kg (5.1 lb)
- Operating temperature range: 10°C to 40°C (50°F to 104°F)
- Charging temperature range: 10°C to 50°C (50°F to 122°F)
- Storage temperature range: – 40°C to 55°C (– 40°F to 131°F)
- AC Power Requirement: 86-127V or 172-254V, 50 to 60 Hz
- Battery Power Requirement: 3.75 Vdc nickel cadmium rechargeable battery pack.

For a complete list of features and functions, see the Comparison Chart on pages 28-29.

The HP-67/97 Fully-Programmable Calculators come complete with:

- Illustrated Owner's Handbook and Programming Guide.
- Quick Reference Card. (HP-67 only)
- Standard Pac complete with 40 cards, card holder, and manual.
- Battery pack that under normal use provides about 3 hours of continuous operation.
- Recharger/AC adapter that lets you operate the calculator on AC while the battery pack is recharging.
- Soft carrying case.
- Programming pad.
- Users' Library and newsletter subscription card.
- 2 rolls of thermal paper (HP-97 only).

Solutions Books

Business

Options/Technical Stock Analysis (00097-14009)
Put & Call Option Fair Values (Black-Scholes)
Call Option Evaluation
Routines for Option Writers
Empirical CBOE Call Pricing
Warrant & Option Hedging
Bull Spread Option Strategy
Butterfly Options
Stock Price 30-Week Moving Average with Data Storage
Exponential Smoothing
Multiple Linear Regression
Curve Fitting, Selecting Best Function

Portfolio Management/Bonds & Notes (00097-14010)
Stock Portfolio Valuation
Portfolio Data Card
Stock Portfolio Beta Coefficient Analysis
True Annual Growth Rate of an Investment Portfolio
Convertible Bond Portfolio Premium Evaluation
Yield on Call Option Sales
Bond Price and Yield
Days between Dates
Bond Yield to Maturity
Interest at Maturity/Discounted Securities
U.S. Treasury Bill Valuation
Convertible Security Analysis

Real Estate Investments (00097-14012)
Mortgage Yield
Mortgage Pricing No. 1
Mortgage Pricing No. 2
Yearly Amortization Schedule
Amount of Equity at Any Time
Ellwood Income Valuation for Income Property Appraisal
Income Property Analysis
Return on Equity Rental Property
Real Estate Investment Analysis
Internal Rate of Return
Depreciation Schedules

Taxes (00097-14004)
Tax Planning 1
Federal Income Tax—Single, Tax Table A
Federal Income Tax—Joint or Separate, Tax Tables B & C
Federal Income Tax—Single (Unmarried) Taxpayers (Schedule X)
Federal Income Tax—Joint or Separate (Schedule Y)
Schedule TC Tax Computation Schedule Form 1040
Tax Deduction Schedule A Form 1040 Medical and Dental
Maximum Tax on Earned Income—1977 and After
Income Averaging Tax
Federal Estate/Gift Tax—1977 and Later
Federal Estate Tax Credit for State Taxes Paid
Estate/Gift Tax Portfolio Valuation

Home Construction Estimating (0097-14033)
Concrete Volume
Linear to Board Feet Conversion & Costing
Framing Board Feet
Lumber Estimate
Shingle Estimate
Wall & Ceiling Areas Estimate
Wallpaper Estimate
Drywall & Insulation Estimate
Sheathing & Subfloor Estimate
Painting Estimate
Wood Floor Estimate

Marketing/Sales (00097-14032)
Forecasting using Exponential Smoothing
Financial Trend Analysis
Seasonal Variation Factors (SEAVAR)
Price Elasticity of Demand

Experience (Learning) Curve for Manufacturing Cost
Breakeven Analysis
Income Statement (P & L) Analysis
Internal Rate of Return-Groups of Cash Flows
Sales Force Requirements
Cost & Price Computations

● **Home Management (00097-14031)**
Income Tax Planning-I
True Cost of Insurance Policy
Automobile Cost/Tire Cost Comparison
Comparison Shopping
Time & Charges Running Total
Reconcile Checking Account
Savings Account Compounded Daily
Accumulated Interest/Remaining Balance
Stock Portfolio Valuation & Data Card
True Annual Growth Rate of an Investment Portfolio
Diet Planning

Small Business (00097-14039)
Hourly Payroll
Invoicing
Account Posting
Percentages & Proportions with Tabulator
Retail Inventory Monitor
Estimating Inventory
Inventory Ordering
Order Point Calculation
Depreciation Schedules
Yearly Amortization Schedule
Federal Corporate Income Tax
Working Capital Needs—Bardahl Formula

Engineering

■ **Antennas (00097-14021)**
Loaded Vertical Antennas
Loaded Dipole Antennas
Gain of a Horizontal Rhombic Antenna at Zero Azimuth
Azimuth Pattern of Cylindrical Array of Antennas
Colinear Antenna Gain & Pattern
Beam Pattern for Uniform Array
Radar Antenna Beamwidth & Gain Antennas
Parabolic Antenna Calculations
RF Path Loss, dB
Antenna Gain or Power of a Remote Transmitter
Planar Phased Array Radar Beam Positions
Radar Parameter Unit Conversions
(Television) Antenna Length & Channel Frequency

■ **Butterworth & Chebyshev Filters (00097-14003)**
Butterworth Active Filter Design, Lowpass
Butterworth & Chebyshev Filter Response
Butterworth & Chebyshev Filter Group Delay
Butterworth & Chebyshev Filter Order Calculation
Butterworth & Chebyshev Lowpass Normalized Coefficients
Normalized Lowpass to Bandpass Filter Transformation for Types 1, 2, 6 & 7
Normalized Lowpass to Bandpass Filter Transformation for Types 8, 9, 10 & 11
Normalized Lowpass to Bandstop, Lowpass, or Highpass
Y-Delta Transform for L, R, or C
Chebyshev Active Lowpass Filter Design & Pole Locations

■ **Thermal & Transport Sciences (00097-14023)**
Psychrometric Properties
Psychrometric Calculations for Water in Air

Equations of State
Isentropic Flow for Ideal Gases
Saturated Steam Properties
Conduit Flow
Parallel & Counter Flow Heat Exchangers
Energy Equation for Steady Flow
Flow with a Free Surface
Pipe Slide-Rule
Force at Bends & Fittings

■ **EE (Lab) (00097-14025)**
Wire Table
Ohm's Law
Reactance Chart (Nine Equations)
Coil Calculations
Complex Impedance Calculator—AC Circuit Calculator
Wye-Delta Transformations
RC Timing
Series R-L-C Circuit Analysis Program
Passive High & Lowpass Composite Filter Design
"L" Attenuator (Generator Impedance Greater than Load Impedance)
1% Resistor Value Subroutine
Wheatstone Bridge

■ **Industrial Engineering (00097-14035)**
Discounted Cash Flow/Present Value Analysis
Depreciation Schedules
Invoicing & Inventory Control
Production Monitor & Record
Learning Curve
x̄ & R Control Chart
Single- & Multi-Server Queues
Two-Way Analysis of Variance with Replications Fixed Effects Model
Multiple Linear Regression for 3 Independent Variables
Simultaneous Equations in Six Unknowns

■ **Aeronautical Engineering (00097-14036)**
Properties of Air
Theoretical U.S. Standard Atmosphere Temperature & Pressure below 35,332 Ft.
Aircraft Flyover Acoustic Tone Doppler Shift
Isentropic Flow for Ideal Gases
Normal & Oblique Shock Parameters for Compressible Flow
Oblique Shock Angle for Wedge
Mach Number & True Airspeed
Take-Off Run vs. Density Altitude
True Air Temperature & Density Altitude
Aircraft Climb

■ **Beams & Columns (00097-14027)**
Compressive Buckling
Eccentrically Loaded Columns
Reinforced Concrete Beams
Concrete Beam Deflection
Torsion-Concentrated Load-Steel Beams (Wide Flange)
Torsion-Uniform Load-Steel Beams (Wide Flange)
A.I.S.C. Steel Column Formula
Concrete Columns Ultimate Strength Design
Column Strength
Beam on Elastic Foundation with Point Load—Any Location

■ **Control Systems (00097-14026)**
Frequency Response of a Transfer Function
Bode of Transfer Function that has each Pole & Zero Given
Bode of Second-Order over Third-Order Transfer Function
Bode of Second-Order over Second-Order Times s* *n Transfer Function
Pole-Zero to Group Delay
Routh Test for Continuous & Discrete Time System Analysis

Convert Frequency Response—Open Loop, Closed Loop
Aid to Root Locus Plots I —Real Poles
Aid to Root Locus Plots II—Complex Poles
Classical Control Gains
First Order Regulator
Second Order Regulator

Computation

■ **High-Level Math (00097-14011)**
Eigenvalues for 3rd Order System
Eigenvalues/Vectors of 3rd Order Systems
Matrix Algebra
Characteristic Equation of a 4 x 4 Matrix
One Card Determinant & Inverse of a 5 x 5 Matrix
Simultaneous Equations in Six Unknowns
Roots of Polynomials
Miscellaneous Special Functions A
Miscellaneous Special Functions B
Incomplete Gamma Function
Incomplete Beta Function
Incomplete Elliptic Integrals

■ **Test Statistics (00097-14008)**
One Sample Test Statistics for the Mean
Test Statistics for the Correlation Coefficient
Differences Among Proportions
Behrens-Fisher Statistic
Kruskal-Wallis Statistic
Mean-Square Successive
The Run Test for Randomness
Intraclass Correlation Coefficient
Fisher's Exact Test for a 2 x 2 Contingency Table
Bartlett's Chi-Square Statistic
Mann-Whitney Statistic
Kendall's Coefficient of Concordance

■ **Geometry (00097-14007)**
Sine Plate Solutions
V Notches & Long Radii
Internal & External Tapers
Points of Tangency with Circles & Arcs
Line-Line Intersection/Grid Points
Points on a Straight Line
Grid of Points: Calculates All Points
Grid of Points: Calculates Discrete Points
Tangent Circle to Two Straight Lines with a Given Radius
Distance between Lines in Space

■ **Reliability/Quality Assurance (00097-14030)**
Reliability: Intra-Class Correlation
Specification Compliance from Limits & Regression Analysis
Parameter Estimation (Exponential Distribution)
Lower Limit of Reliability—Binomial Distribution
Reliability & Probability of Failure of Series & Parallel Systems
MIL-STD-883 Calculated Leak Rate
MLE: θ from Hazard Rate
MLE: θ by Least Square Method
Systems Reliability-Series & Parallel with Same Failure Rate λ
Systems Reliability-Series & Parallel with Different Failure Rate λ

Medical

■ **Medical Practitioner (00097-14005)**
Blood Pressure Averages & Mean Arterial Pressure
Pacemaker Rate & Interval Averager
Blood Alcohol
Human Post-Trauma Epilepsy Seizure Prediction
Bedside Blood-Gas Interpreter
Body Density, Fat & Lean Mass from Skinfolds
Estimating Obesity, Body Fat Surface Area & Total Body Water

These HP-67/97 books contain between 10 and 15 programs each in diverse areas such as business, math, statistics, medicine, physical science, life science and others. Simply record the programs on your own magnetic cards and you have an application pac in your chosen field.

Fluid & Electrolytes/Body Burn Area
Fluid & Electrolytes/Potassium Balance (Scribner)
Anesthesiology Parameters
Discounted Cash Flow Analysis—Net Present Value
Income Property Analysis
Income Tax Planning—I
Income Tax Planning—II
■ **Anesthesia (00097-14019)**
Anesthesia Parameters I
Anesthesia Parameters II
Pulmonary Medicine: Respiratory Set Up & Deadspace Adjustment
Copper Kettle Anesthetic Regulation
Anesthesia: Antoine Values from Experimental Data
Anesthesia: Vapor Pressure of Water
Anesthesia: Vapor Pressure of Halothane
Anesthesia: Vapor Pressure of Diethyl Ether
Anesthesia: Vapor Pressure of Methoxyflurane
Anesthesia: Vapor Pressure of Enflurane
Anesthesia: Vapor Pressure of Fluroxene
Anesthesia: Vapor Pressure of Cyclopropane
Anesthesia: Vapor Pressure of Trichlorethylene
Anesthesia: Vapor Pressure of Ethyl Chloride
■ **Cardiac (00097-14018)**
Virtual PO_2 & O_2 Saturation & Content
Body Surface Area for Cardio Pulmonary Programs
Dye Curve Cardiac Output
Fick Cardiac Output
Valve Area
Anatomic Shunts
Contractility
Stroke Work
Ejection-Fraction Ejected-Volume, Cardiac Output
Calculation of Left Ventricular Functions from Angiographs
Impedance Cardiac Output, Systemic & Pulmonary Resistance
Basic EKG Determinations
■ **Pulmonary (00097-14037)**
Pulmonary Medicine/Male Spirometry Standards
Pulmonary Medicine/Female Spirometry Standards
Lung Diffusion
Water Vapor Pressure & Respiratory Gas Conversions
Ventilator Setup & Corrections (Radford)
Arterial CO_2 Normalization
Blood Acid-Base Status
Virtual PO_2 & O_2 Saturation & Content
Anaerobic PCO_2 & pH Change
Anaerobic PO_2 Change
Dead Space Fraction
Alveolar-Arterial Oxygen Tension Difference
Physiologic Shunt & Fick
Body Surface Area for Cardio Pulmonary Programs

Physical/Life Sciences

■ **Chemistry (00097-14006)**
pH of Weak Acid/Base Solutions
Acid-Base Equilibrium (Diprotic)
Weak Acid/Base Titration Curve
Equations of State
Van Der Waals Gas Law
Beer's Law & Absorbtivity Calculations
Activity Coefficients from Potentiometric Data
Crystallographic to Cartesian Coordinate Transformations
Kinetics using Lineweaver-Burk or Hofstee Plots

Mixture Viscosities
Vapor Pressure, Bubble & Dew Point Calculation
Single-Stage Equilibrium Calculation
■ **Optics (00097-14016)**
Optical Design I
Optical Design II
Lens Calculations-Sag, Angle, Min/Max
Ray Tracer—Spherical, Paraboloidal & Flat Surfaces
General Lens Tracer
Ray Tracer
First Order Ray Tracing by Matrix Methods
Fraunhofer Diffraction of Light by Spherical Particles
Kubelka-Munk Diffuse Layer Reflectance & Transmittance
Ray Trace Parabola
Paraxial Ray Tracing Part 1: Tracing
Paraxial Ray Tracing Part 2: Storing
■ **Physics (00097-14015)**
Black Body Thermal Radiation
Black Hole Characteristics
Special Relativity Conversions
Three-Dimensional Special Relativity
Einstein's Twin Paradox
Delta-V—Orbit Simulator
Equations of Particle Motion
Ballistics Trajectory Computations
Isotope Overlap Corrections
Critical Reactor Code
Semi-Empirical Nuclear Mass Formula
Clebsch-Gordon Coefficients & 3j Symbols Evaluation
32-P Remaining on MM.DDYYYY Given MCI on Earlier MM.DDYYYY
■ **Earth Sciences (00097-14017)**
Earthquake Magnitude—Energy Conversion
P & S Seismic Wave Velocity Determination
Electromagnetic Seismograph Frequency Response
Earthquake Seismic Wave Radiation Pattern: Shear Fault
Plate—Tectonic Velocities
Plunge & Rake of Faults
Depth of Strata
Strata Thickness
True & Apparent Dips
Bouguer Anomaly Gravity Reduction
Geocentric Distance—Azimuth—Back Azimuth
Heat Flow
Physical Properties of Seawater
Sigma-T & AOU
Atmosphere Thermodynamics
■ **Energy Conservation (00097-14029)**
Air Cooling System Design
Black Body Thermal Radiation
Economic Insulation Thickness
Heat Transfer through Composite Cylinders & Walls
Steady State Conduction Heat Transfer, Heat Load & Logarithmic Mean Temperature Difference
Sun Altitude, Azimuth, Solar Pond Absorption
Total Daily Amount of Solar Radiation
Transient Temperature Distribution in a Semi-Infinite Solid
Temperature or Concentration Profile for a Semi-Infinite Solid with Convection Boundary Condition
Conservation of Energy
■ **Space Science (00097-14028)**
Precession of Right Ascension & Declination
Local Sidereal Time & Obliquity from Local Standard Time
Space Science & Technology No. 1 Horizon Distance, Great Circle Distance
Space Science & Technology No. 2 Vis Viva & Path Angle Relations

Space Science & Technology No. 4 Ballistic Missile Range
Celestial Position
Binary Star Ephemeris
Precession/Galactic Coordinates
Space Science & Technology, No. 5 Kepler's Equation
Orbit Determination by the Method of Gauss
■ **Forestry (00097-14034)**
Log Volume in Cubic Feet, Cubic Meters, or Board Feet
Lumber Scale-Board Feet Recoverable from a Log
Logging Calculations—Doyle's Method
True Productivity of a Natural Coniferous Forest
Mean Annual Increment of Various Forests
Standing & Running Skyline Loadcarrying Capability
Cruiser's Stick for Forest Mensuration
Latitude & Longitude from Geological Survey Map
Mean Annual Increment of Douglas Fir & Certain Pine Forests
Traverse, Inverse, & Sideshots
■ **Biology (00097-14040)**
Demography I: Estimates of Parameters/Rates of Increase
Demography II: Expectation of Life & Reproductive Value
Diversity & Equitability Indices
Niche Breadth & Overlap/Shannon's H & Horn's R0
Population Size Estimate (Jolly's Estimate)
Cell Phase & Cycle Times
Crossover: Location/Products
Chromosome Cleavage
Recessive Gene Frequency after Selection, Mutation, Inbreeding
Selection & Gene Frequency
Genetic Inference from Truncate Data
Positive Assortative Mating for a Recessive Phenotype

Other

■ **Games (00097-14013)**
Risk
Blackjack with a Permanent Bank
Bell-Fruit (Mills Standard)
Turn the Die
Word Encoder
Word Game Subroutine
Hangman Word Game
Pro Football Simulation
Electronic Contract Bridge Score Pad
Duplicate Bridge Score with Running Totals
Battleship
■ **Games of Chance (00097-14038)**
Craps
Twenty-Six & Thirty-Six
Chuck-A-Luck Dice Game
Parapar
Pig
Big Six
Roulette
Dog Races
Horse Race
Blackjack Betting
■ **Aircraft Operation (00097-14001)**
Aircraft Flight Plan with Wind
Flight Management
Predicting Freezing Levels
General Aircraft Weight & Balance
Pilot Unit Conversions
Turn Performance
Rate of Climb & Descent
Head Winds & Cross Winds
Flight Planning & Flight Verification
Determining In-Flight Winds

Standard Atmosphere
Mach Number & True Airspeed
True Air Temperature & Density Altitude
Lowest Usable Flight Level
■ **Avigation (00097-14002)**
Great Circle Plotting
Rhumb Line Navigation
Great Circle Navigation
Position given Heading, Speed & Time
Line of Sight Distance
Position and/or Navigation by Two VOR's
Position by One VOR
DME Speed Correction
Average Wind Vector
Course Correction
Time of Sunrise & Sunset
Azimuth of Sunrise & Sunset
■ **Calendars (00097-14024)**
Calendar Date/Julian Date Conversion
Days to Dates & Dates to Days; Day of Week
Day of Year—Day of Week
Number of Weekdays between Two Dates
In What Year is a given Date an M-Day?
Number of M-Days between Two Dates & Nth M-Day of the Month
Holidays
Easter-Ash Wednesday-Religious Holidays
Complete Maya Calendar
Mohammedan (Islam)—Gregorian Calendar Conversion
Chinese Years to/from Gregorian Years
Biorhythm—Biological Cycles
New Moon & Full Moon Day of Month
■ **Photo Dark Room (00097-14022)**
Macro-Photograhy & Enlarging
Time, F-Stop, Magnification, Paper Speed, Enlarging Factors
Color Printing Factors
Color Printing Factors; New Paper
Subtractive Color-Printing Filters; Density Correction
Tri-Color Print Exposure (Photo)
Color Print Processing in Drum
Cibachrome Reciprocity Correction
Print Viewing Distance
Photo/Image Display Parameters
Image Projection Data
■ **COGO/Surveying (00097-14020)**
Basic Traverse, Inverse and Sideshots
Bearing-Bearing Intersection and Traverse
Bearing-Distance Intersection and Traverse
Distance-Distance Intersection and Traverse
Traverse of Curve
Curve Inverse and Traverse
Compass Rule Adjustment
Rotation of Axes
To Inscribe Curve
Slope Shot Traverse
Crandall's Rule Adjustment
Transit Rule Adjustment
■ **Astrology (00097-14014)**
Astro 1—Mean Obliquity of the Ecliptic & Greenwich Sidereal Time
Astro 2—Moon's Ascending Node, Nutation, & SVP
Astro 3—Local Sidereal Time, Geocentric Latitude, MC and Ascendant
Mundoscope, Regionmontanus
Mundoscope, Campanus
House Cusps—Placidus Method (Exact)
House Cusps—Regionmontanus Method
House Cusps—Campanus Method
House Cusps—Topocentric Method
House Cusps—Koch (GOH) Method
Astrological Horoscope Construction

Application Pacs

EE Pac

(00097-13131)

- Network Transfer Functions
  This program computes various transfer functions of a ladder network composed of any number of standard elements.
- Reactive L-Network Impedance Matching
  This program computes networks which will match any two complex impedances.
- Class A Transistor Amplifier Bias Optimization
  This program simplifies the design of a class A transistor amplifier.
- Transistor Amplifier Performance
- Transistor Configuration Conversion
- Parameter Conversion: $S \rightleftharpoons Y, Z, G, H$
- Fourier Series
- Active Filter Design
- Butterworth or Chebyshev Filter Design
- Bode Plot of Butterworth and Chebyshev Filters
- Resistive Attenuator Design
- Smith Chart Conversions
- Transmission Line Impedance
- Microstrip Transmission Line Calculations
  This program computes relative phase velocity and characteristic impedance for lossless microstrip. It also computes copper loss and resistance per unit length.
- Transmission Line Calculations
  This program computes the input impedance of lossy transmission line terminated in Z_L.
- Unilateral Design: Figure of Merit, Maximum Unilateral Gain Circles
  This program computes u, G_u, G_{min}, G_{max}, G_0, $G_{1\ max}$, and $G_{2\ max}$ from a transistor's s-parameters. It also computes r_{01} and ρ_{01} from $G_1 \leq G_{max}$ (i = 1, 2).
- Bilateral Design: Stability Factor, Maximum Gain, Optimum Matching
  This program computes the maximum gain available and the load and source reflection coefficients which yield the maximum gain.
- Bilateral Design: Gain and Stability Circles, Load and Source Mapping
  This program computes the location and radius of stability circles. It also computes the source or load reflection coefficient corresponding to a given load or source termination.

Business Decisions Pac

(00097-13144)

- Internal Rate of Return
  Yield of a sequence of uneven cash flows.
- Internal Rate of Return—Groups of Cash Flows
  Yield of groups of uneven cash flows.
- Discounted Cash Flow Analysis—Net Present Value
- Direct Reduction Loans—Sinking Fund
- Accumulated Interest/Remaining Balance
- Wrap-Around Mortgage
  Calculates yield of wrap-around mortgage.
- Constant Payment to Principal Loan
- Add-on Rate Installment Loan/Rule of 78's
- Savings Plan-Leases
- Advance Payments
  Payment and yield calculations when additional payments are made in advance.
- Savings—Compounding Periods Different from Payment Periods
- Simple Interest/Interest Conversions
- Depreciation Schedules
  Straight line, SOYD, declining balance, and crossover between straight line and declining balance.
- Days Between Dates
- Bond Price and Yield
- Interest at Maturity/Discounted Securities
- Linear Regression—Exponential Curve Fit
  Fits a set of data points x, y to a straight line and a curve. Determines goodness of fit.
- Multiple Linear Regression
- Break-Even Analysis
- Invoicing
  Maintains net line totals, subtotal and grand total for invoicing.
- Payroll
  Guide for writing a payroll program.
- Inventory
  Guide for establishing an inventory program.

Clinical Lab and Nuclear Medicine Pac

(00097-13165)

Clinical Chemistry
- Beer's Law
- Protein Electrophoresis
  Given integration counts of a number of protein fractions, finds percentage of each.
- LDH Isoenzymes
  Given values for the five LDH isoenzymes, finds activity of each as a percent of total. Compares results against normal values.
- Body Surface Area
- Urea Clearance
- Creatinine Clearance
- Amniotic Fluid Assay
  Calculations for the spectrophotometric estimation of bile pigments in amniotic fluid.
- Blood Acid-Base Status
  Finds total plasma CO_2 and base excess from PCO_2, pH, and Hgb concentration.
- Oxygen Saturation and Content
  Finds oxygen saturation and content in blood given PO_2, PCO_2, pH, and body temperature.
- Red Cell Indices
  Given hematocrit percent, red cell count, and hemoglobin, finds mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration.

Nuclear Medicine
- Total Blood Volume
- Schilling Test
  The radioisotope determination of vitamin B_{12} absorption.
- Thyroid Uptake
- Radioactive Decay Corrections

Radioimmunoassay
- Radioimmunoassay
  Computes least-squares regression line of logit of net counts vs. log concentration, including regression constants, correlation coefficient, and concentration for a given count.

Statistics
- Basic Statistics
  Computes mean, standard deviation, standard error, and coefficient of variation for grouped or ungrouped data.
- Chi-Square Evaluation and Distribution
  Computes the chi-square statistic for goodness of fit.
- t Statistics
- t Distribution

CE Pac

(00097-13195)

- Vector Statics
- Section Properties (2 Cards)
  The area, centroid, and moments of an arbitarily complex polygon may be calculated.
- Properties of Special Sections
  Section properties for rectangles, triangles, ellipses, circles and concentric circles.
- Stress on an Element
  Reduces data from rosette strain gage measurement and performs Mohr circle analysis.
- Bending or Torsional Stress
  Solves either the bending stress equation (s = Mv/I) or the analogous torsional sheer equation (s = TR/J) interchangeably for all variables.
- Linear or Angular Deformation
- Cantilever Beams
  Calculates deflection, slope, moment and shear for point, distributed, and moment loads applied to cantilever beams.
- Cantilever Beams—Trapezoidal Load
- Simply Supported Beams
- Simply Supported Beams — Trapezoidal Loads
- Beams Fixed at Both Ends
- Beams Fixed at Both Ends— Trapezoidal Loads
- Propped Cantilever Beams
- Propped Cantilever Beams—Trapezoidal Load
- Six-span Continuous Beams
- Steel Column Formula
- Reinforced Concrete Beams
- Bolt Torque

Navigation Pac

(00097-13205)

- Estimated Time of Arrival
- Great Circle and Rhumb Line Navigation
- Dead Reckoning
- Velocity Triangle and Course to Steer
- Star Sight Planner (2 cards)
  Produces a list of available stars given location, date and time. Also gives approximate time of middle of morning and evening twilight periods.
- Almanac Interpolater
- Sun Line of Position
- Star Line of Position (7 cards)
- Bearing Line of Position
- Two-Angle Line of Position
- Fix from Two Lines of Position
- Radar Plotting Closest Point of Approach
- Beating to Windward
  From measurements made on your boat, your speed-made-good and course-made-good are calculated. Then time to the lay line, course and speed-made-good on the next tack, and time to the mark are computed.
- Distance by Horizon Angle

Surveying Pac

(00097-13175)

- Traverse, Inverse and Sideshots
  Reduction of field traverse data with closure and area calculation.
- Traverse Adjustment
  Adjustment of traverses by compass rule or Crandall's rule.
- Intersections
  Bearing-bearing, bearing-distance and distance-distance intersections and offset from a point to a line.
- Curve Solutions
- Horizontal Curve Layout
- Spiral Curve Layout
- Vertical Curves and Grades
- Resection
  Solution of the "three point problem."
- Two Instrument Radial Survey
- EDM Slope Reduction
- Stadia Reduction/3-Wire Leveling
- Taping Reduction/Field Angle Check
- Azimuth of the Sun
- Predetermined Area
  Location of one side of a land parcel to enclose a specified area.
- Earthwork
- Coordinate Transformation

With HP-67/97 Application Pacs, the solutions you require may already exist. Application Pacs contain 15 to 26 preprinted prerecorded program cards, a program card holder and a manual of complete documentation. You save significant time because no researching, programming, debugging or documenting is needed.

- State Plane Coordinates—Lambert
- State Plane Coordinates—Transverse Mercator
- State Plane Coordinates—Alaska Zones 2-9

Stat Pac

(00097-13111)
General Statistics
- Basic Statistics for Two Variables
  Basic statistics for two variables, grouped or ungrouped.
- Factorial, Permutation, and Combination
- Moments, Skewness, and Kurtosis (For Grouped or Ungrouped Data)
- Random Number Generator
  Generate up to 500,000 different numbers.
- Histogram
  A histogram program for 24 intervals of equal width between specified upper and lower limits.

Analysis of Variance
- Analysis of Variance (One Way)
- Analysis of Variance (Two Way)
- Analysis of Covariance (One Way)

Distribution Functions
- Normal and Inverse Normal Distribution
- Chi-Square Distribution
- t Distribution
- F Distribution
  This program evaluates the integral of the F distribution for given values of $x(>0)$, degrees of freedom ν_1, ν_2, provided either ν_1 or ν_2 is even.

Curve Fitting
- Multiple Linear Regression
  Linear regression for two independent variables, using least squares method.
- Polynomial Approximation
  This program approximates in the least square sense the function $f(x)$ by a polynomial of degree m, where $2 \leq m \leq 4$. Data from equally spaced points are required.

Test Statistics
- t Statistics
  Paired t statistic tests the null hypothesis Ho: $\mu_1 = \mu_2$ for two observations.
  t statistic for two means tests the null hypothesis Ho: $\mu_1 - \mu_2 = d$ for two independent random samples.
- Chi-Square Evaluation
- Contingency Table
  $2 \times k$ and $3 \times k$ contingency tables test the null hypothesis that two variables are independent.
- Spearman's Rank Correlation Coefficient
  This program tests whether 2 rankings are substantially in agreement with one another.

Quality Control
- $\bar{x}$ and R Control Chart
  $\bar{x}$ (mean) and R (range) are used to decide periodically whether a process is in statistical control.

- Operating Characteristic Curves
  This program evaluates the probability P_a of acceptance for a single sampling plan with finite or infinite lot size.
Queueing Theory
- Single- and Multi-Server Queues
  Queueing theory for infinite customers and finite customers.

Math Pac

(00097-13121)
- Factors and Primes
- GDC, LCM, Decimal to Fraction
- Base Conversions
- Optimal Scale for a Graph; Plotting
  Finds a "nice" scale for graphing a function; generates ordered pairs for a graph.
- Complex Operations
- Polynomial Solutions
  Solves polynomial equations up to 5th degree.
- 4 x 4 Matrix Operations(2 cards)
  Computes determinant and inverse of 4 × 4 matrix, solves 4 simultaneous equations in 4 unknowns, by Gaussian elimination.
- Solution to f(x) = 0 on an Interval
  Uses combination of bisection and secant method to guarantee rapid convergence to a root.
- Numerical Integration
  Trapezoidal rule and Simpson's rule for discrete case; Simpson's rule for functions known explicitly.
- Gaussian Quadrature
  Uses the six-point Gauss-Legendre quadrature method to find integrals over finite or infinite intervals.
- Differential Equations
  Solves first- and second-order differential equations by the fourth-order Runge-Kutta method.
- Interpolations
  Linear, Lagrangian, and finite difference.
- Coordinate Transformations
  Two- and three-dimensional translation and rotation of axes.
- Intersections
  Line-line, line-circle, circle-circle.
- Circles
- Spherical Triangles
- Gamma Function
- Bessel Functions, Error Function
- Hyperbolics

ME Pac

(00097-13155)
- Vector Statics
- Section Properties (2 cards)
  The area, centroid, and moments of an arbitrarily complex polygon may be calculated using this program.
- Stress on an Element
  Reduces data from rosette strain gage measurement and performs Mohr circle analysis.

- Soderberg's Equation for Fatigue
- Cantilever Beams
  Calculates deflection, slope, moment and shear for point, distributed, and moment loads applied to cantilever beams.
- Simply Supported Beams
- Beams Fixed at Both Ends
- Propped Cantilever Beams
- Helical Spring Design
  Performs one or two point design for helical compression springs.
- Four Bar Function Generator (2 cards)
  Program designs four bar systems which will approximate an arbitrary function of one variable.
- Progression of Four Bar System
  Calculates angular displacement, velocity, and acceleration for the output link of a four bar system.
- Progression of Slider Crank
  Calculates displacement, velocity, and acceleration of the slider and angular velocity and acceleration of the connecting rod for the progression of a slider crank system.
- Circular Cams
  Computes parameters necessary for design of harmonic or cycloidal, circular cams with roller, flat or point followers.
- Linear Cams
  Computes the parameters necessary for design of harmonic, cycloidal, or parabolic profiles for linear cams with roller followers.
- Gear Forces
  Computes the reaction forces resulting from torque applied to helical, bevel, and worm gears.
- Standard External Involute Spur Gears
  Calculates parameters necessary in design manufacture, and testing of standard, external, involute, spur gears.
- Belt Length
  Computes belt length around an arbitrary set of pulleys.
- Free Vibrations
- Vibration Forced by $F_0COS\omega t$
- Equations of State
  Ideal gas relation plus Redlich-Kwong model of real gas behavior.
- Isentropic Flow for Ideal Gases
  Replaces isentropic flow tables for ideal gases in converging-diverging passages.
- Conduit Flow
- Heat Exchangers (2 cards)
  Performs analysis of counter-flow, parallel-flow, parallel-counter-flow and crossflow (fluids unmixed) heat exchangers.

Games Pac

(00097-13185)
- Game of 21
- Dice
  Includes the game of "Craps" as well as a dice roller.
- Slot machine

- Submarine Hunt
  Find and then sink the moving submarine with your depth charges.
- Artillery
  Locate and destroy the moving target before it destroys you.
- Space War
  Search out and annihilate the 3 evil Alglogs before time and energy are gone.
- Super Bagels
  Based on "Mastermind."
- Nim_k
  Who will pick the last object from the last pile, you or the calculator?
- Queen Board
  You and the calculator take turns moving a chess queen to its target.
- Hexapawn
  You and the calculator command armies of 3 chess pawns each.
- Tic-Tac-Toe
- Wari
  Also known as Man-Kalah.
- Racetrack
- Teaser
  Changing from one pattern to the other looks easy, but …
- Golf
- The Dealer
  Shuffles and deals a deck of cards to 4 people; also calls Bingo.
- Bowling Scorekeeper
- Biorhythms
- Timer
  Offers 2 visible timers, a count-up and count-down timer, and allows splits to be taken.

Standard Pac

(00097-13101)
(00067-13101)
- Moving Average
- Tabulator
- Curve Fitting
- Calendar Functions
- Annuities and Compound Amounts
- Follow Me
  The programmable program.
- Triangular Solutions
- Vector Operations
- Polynomial Evaluation
- Matrix Operations
- Calculus and Roots of f(x)
  Approximates the derivative of a function at a point, evaluates a function at a point, and approximates the integral over a finite interval for a user specified function f(x). Also, approximates real roots of f(x).
- Metric Conversions
- Arithmetic Teacher
  Generates arithmetic problems for preschool and elementary students.
- Moon Rocket Lander
- Diagnostic Program

Accessories

Optional Accessories.

A. DC Adapter/Recharger.
Lets you recharge your calculator in a car or boat.

This accessory, which is most often asked for by our existing customers, operates from a 12-volt DC battery.

- HP-21, HP-22, HP-25/25C, HP-27/82055A
- HP-80 and HP-67 (Pictured below)/82054A*

B. Reserve Power Pack.
Keeps a spare battery pack fully charged.

You'll always have a fully-charged spare battery pack on hand when you use this reserve power pack, especially designed for Hewlett-Packard pocket calculators. It comes complete with a spare battery pack.
   Simply slip the battery pack into the holder, then plug the holder into the recharger/AC adapter that comes with your calculator. A built-in light-emitting diode tells you that the battery pack is recharging.

- Battery pack and holder for models HP-80 and HP-67/82004A*
- Battery pack and holder for models HP-21, HP-22, HP-25/25C, HP-27, HP-29C (Pictured below)/82028B
- Battery pack and holder for models HP-91, HP-92, HP-97 (Pictured below)/82037A

C. Security Cradle/Cable.
Helps reduce pilferage.

When leaving your HP calculator unattended in the office or lab, you can help guard it against "mysterious disappearance" by means of a ruggedly-constructed security cradle or a security cable.
   The security cradle may be attached to your desk via: (1) four corner screws, (2) center screw attachment, allowing 360° rotation, (3) removable six-foot steel cable, or (4) extremely hard-to-remove adhesive tape. (All are supplied.)

- Security cradle for model HP-80/82007A***
- Security cradle for model HP-67/82015A**
- Security cradle for models HP-21, HP-22, HP-25/25C, HP-27, HP-29C (shown), has built-in prism to provide better viewing angle when on flat surface/82029A
- Security cable for models HP-10, HP-19C, HP-91, HP-92, HP-97/82044A

D. Hard Leather Case.
Helps protect your calculator outdoors.

Using your HP calculator outdoors? Help protect it by carrying it in this hard leather field case. It guards your calculator against normal environmental conditions in the field—dust, dirt, rain, snow, bumps and jars. Calculator removal is easy with the snap-open flap and contoured front opening.

- Field case for model HP-80/82006A***
- Field case for model HP-67/82016A***

Replacement Accessories.

Accessories to replace or replenish those received with your HP calculator.

E. Battery Pack

- HP-31E, HP-32E, HP-33E, HP-37E, HP-38/82109A
- HP-10, HP-19C/82052A
- HP-21, HP-22, HP-25/25C, HP-27, HP-29C/82019B
- HP-80 and HP-67 (pictured below)/82001A*
- HP-91, HP-92, and HP-97/82033A

F. Recharger/AC Adapter

Please contact the sales office or dealer nearest you for ordering information on this valuable accessory. Regional addresses appear on the back cover of the Digest.

G. Soft Case

- HP-31E, HP-32E, HP-33E, HP-37E, HP-38E/82110A
- HP-10, HP-19C/82064A
- HP-21, HP-22, HP-25/25C, HP-27, HP-29C/82027A
- HP-80/82021A***
- HP-67/82053A** (synthetic)
- HP-67/82017A** (black leather)
- HP-91, HP-92, HP-97/82035A

Designed to protect and increase the versatility of Hewlett-Packard Calculators.

Calculator Supplies

- Thermal Printing Paper for models HP-10, HP-19C/82051A (6 rolls)
- Thermal Printing Paper for models HP-91, HP-92, HP-97 (pictured below)/82045A (6 rolls)
- 3 Program Card Holders for models HP-67 and HP-97/00097-13142**
- Program Pad for models HP-19C, HP-25/25C, HP-29C, HP-33E, HP-38E, HP-67, HP-97/00097-13154**
- Blank Program Cards for models HP-67 and HP-97/
  40 card pac with holder/00097-13141**
  120 card pac with holders/00097-13143**
  1000 card pac/00097-13206**

Owner's Handbooks
(English) †

- HP-31E/00031-90001
- HP-32E/00032-90001
- HP-33E/00033-90001
- HP-37E/00037-90001
- HP-38E/00038-90001
- HP-10/00010-90001
- HP-19C/29C/5955-2110
- HP-21/00021-90001

- HP-22/00022-90001
- HP-25/25C/00025-90001
- HP-27/00027-90001
- HP-67/00067-90011
- HP-80/00080-90001
- HP-91/00091-90001
- HP-92/00092-90002
- HP-97/00097-90001

Application Books and Pacs.

For software in local languages please contact the sales office or dealer nearest you. Regional addresses appear on the back cover of the Digest.

Application Books
(English) †

- HP-31E, HP-32E, HP-33E "Solving Problems With Your Hewlett-Packard Calculator"/5955-3015
- HP-33E Applications Books
  Standard/00033-90024
  Mathematics/00033-90030
  Statistics/00033-90031
  Student Engineering/00033-90032
  Surveying/00033-90033

- HP-37E, HP-38E "Your HP Financial Calculator"/5955-3016
- HP-37E, HP-38E Applications Books
  Real Estate Applications/00038-90024
  Lending, Savings and Leasing/00038-90025
  Investment Analysis and Statistics Applications/00038-90026
- HP-19C/29C Applications Book/5955-2111
- HP-21 Applications Book/00021-90016
- HP-25/25C Application Programs/00025-90011
- HP-80 Real Estate Applications/00080-66006
- HP-92 Applications/00092-90011

HP-19C/29C Solutions Books
(English) †

- Civil Engineering/00029-14008
- Electrical Engineering/00029-14004
- Financial/00029-14003

- Games/00029-14006
- Mathematics/00029-14001
- Mechanical Engineering/00029-14009
- Navigation/00029-14007
- Statistics/00029-14002
- Student Engineering/00029-14010
- Surveying/00029-14005

HP-67/97 Solutions Books

Refer to pages 22 and 23 for a complete listing of HP-67/97 Users' Library Solutions Books.

HP-67/97 Application Pacs

Refer to pages 24 and 25 for a complete listing of HP-67/97 Application Pacs.

*Also usable on HP-35, HP-45, HP-55, HP-65, and HP-70.
**Also usable on HP-65.
***Also usable on HP-35, HP-45, HP-55, and HP-70.

†For handbooks in local languages, please contact the sales office or dealer nearest you. Regional addresses appear on the back cover of the Digest.

G

E

F

Comparison Chart

Features/Functions	PREPROGRAMMED BUSINESS			PROGRAMMABLE SCIENTIFIC				PREPROGRAMMED SCIENTIFIC	
	HP-10 PAGE 14	HP-37E PAGE 10	HP-92 PAGE 12	HP-38E PAGE 11	HP-67/97 PAGE 20-21	HP19C/29C PAGE 18-19	HP-33E PAGE 17	HP-32E PAGE 16	HP-31E PAGE 15
RPN Logic System		●	●	●	●	●	●	●	●
Memory									
Automatic four-memory stack		●	●	●	●	●	●	●	●
Addressable memory	●	7	30	20-7	26	30	8	15	4
Financial memory		5	8	5					
Last x memory			●	●	●	●	●	●	●
Program memory				8-99	224	98	49		
Continuous Program Memory						98			
Continuous Addressable Memory						16			
Positioning Operations									
Stack roll down		●	●	●	●	●	●	●	●
Stack roll up			●		●	●			
x, y memory exchange		●	●	●	●	●	●	●	●
x, I memory exchange					●	●			
Display									
Mantissa				●	●	●	●	●	●
Fixed notation	●	●	●	●	●	●	●	●	●
Scientific notation		●	●	●	●	●	●	●	●
Engineering notation					●	●	●	●	●
Automatic overflow into scientific		●	●	●	●	●	●	●	●
Automatic underflow into scientific		●	●	●	●	●	●	●	●
Enter exponent		●	●	●	●	●	●	●	●
Change sign		●	●	●	●	●	●	●	●
Programming Features									
Program review—back step / single step				●	●	●	●		
Insert/delete					●	●			
Overwrite				●			●		
Direct branching				●	●	●	●		
Pause					●	●			
Conditional tests				2	8	8	8		
Flags						4			
DSZ, ISZ (looping)					●	●			
3 levels of subroutines						●			
Smart card reader									
Stores programs and data					●				
Merges programs and data					●				
Automatic prompting					●				
Labels					20	10			
10 user-definable functions					●				
Indirect control of:									
Data storage and recall					●	●			
Storage arithmetic					●	●			
Unconditional branching					●	●			
Subroutine branching					●	●			
DSZ, ISZ					●				
Display					●				
Relative addressing					●	●			
Clearing Options									
Clear x	●	●	●	●	●	●	●	●	●
Clear stack								●	●
Clear all	●	●	●	●				●	●
Clear addressable registers	●	●	●	●	●	●		●	●
Clear statistical registers		●	●	●	●	●			
Clear prefix					●	●	●	●	●
Clear program memory				●	●	●	●		
Clear financial registers		●	●	●					
Printing Features									
Print x	●		●		97	19C			
List stack registers			●		97	19C			
List addressable registers			●		97	19C			
List statistical registers			●			19C			
List financial registers			●						
Print crosshatch separator	●								
Paper advance	●				97				
Three print modes			●		97	19C			
Print space					97	19C			
List program					97	19C			
Trace program					97	19C			

This chart has been designed for your convenience in making direct comparisons of the features and functions on the HP calculators described in the following pages. For your convenience, page numbers of catalog listings are indicated alongside each calculator.

	PREPROGRAMMED BUSINESS				PROGRAMMABLE		SCIENTIFIC		PREPROGRAMMED
Features/Functions	HP-10 PAGE 14	HP-37E PAGE 10	HP-92 PAGE 12	HP-38E PAGE 11	HP-67/97 PAGE 20-21	HP19C/29C PAGE 18-19	HP-33E PAGE 17	HP-32E PAGE 16	HP-31E PAGE 15
Built-in Statistical Functions									
Mean, standard deviation (no. of variables)		2	2	2	2	2	2	2	
Linear regression/estimate		■			•		■	■	
Factorial		■							■
Summations (n, Σx, Σx², Σy, Σy²,Σxy)		■		■	•	■	■	■	
Correlation coefficient		■			•	■			
Variance				★	•				
Normal distribution				★	•			★	■
Built-in Financial Functions									
Number of periods		■	■		•				
Interest rate/period		■	■		•				
Payment/period		■	■		•				
Present value		■	■		•				
Future value		■	■		•				
Simple interest			■		•				
Accumulated interest, Remaining Balance		■	■		•				
Bond prices, yield			■	★	•				
Rule of 78's interest rebate			■	★	•				
Net present value			30	20-1980	•				
Internal rate of return			30	20-1980	•				
Bond/note switch			■						
Beginning/ending period switch		■	■		•				
Straight line depreciation			■	★	•				
Declining Balance depreciation			■	★	•				
Sum-of-the-year's digits depreciation			■	★	•				
Built-in Scientific Functions/Mathematics									
Trigonometric:									
Decimal degrees, Radians, Grads mode					•	■	■	■	■
Sin x, Sin⁻¹x, Cos x, Cos⁻¹x, Tan x, Tan⁻¹x					•	■	■	■	■
Rectangular coordinates ↔ Polar coordinates					•	■	■	■	
Decimal angle ↔ Angle in deg (hr.)/min/sec					•	■	■	■	
Angle in degrees ↔ Angle in radians					•	■	■	■	
Angle (time) arithmetic					•				
Hyperbolic Trigonometric:									
Sinhx, Sinh⁻¹x, Coshx, Cosh⁻¹x, Tanhx, Tanh⁻¹x					•			■	
Logarithmic:									
Log x, 10ˣ					•	■	■	■	■
ln x, eˣ		■	■	■	•	■	■	■	■
Metric Conversions:									
Inch ↔ Millimeter					•			■	■
Btu ↔ Joule					•				
Foot ↔ Meter					•				
Gallon ↔ Liter					•			■	■
Pound ↔ Kilogram					•			■	■
Force in pounds ↔ Newton					•				
Fahrenheit ↔ Celsius					•				■
Other:									
yˣ, √x, 1/x		■	■	■	■	■	■	■	■
x²					■	■	■	■	■
π					■	■	■	■	■
%	■	■	■	■					
Price		■							
Δ %		■						■	
% Σ /% T		■	■	■				■	
+, −, ×, ÷	■	■	■	■	■	■	■	■	■
Repeat add or subtract	■								
Absolute value					■	■	■		
Integer/fraction truncation				■	■	■	■		
Special Features									
360/365-day switch			■						
Calendar			■		•				
Rounding			■		■				
Add Mode	■								
Commas in display		■		■			■	■	■
Self-check		■		■			■	■	■

• Not a built-in function, but available on pre-recorded magnetic program cards.

★ Not a built-in function but programs found in application books.

Engineering for the cold, cruel world.

A surprising attention to detail prepares an HP calculator for a long life of hard work and hard knocks.

Here are some of the interesting—and sometimes surprising—things our engineers insist on to ensure the performance, quality and durability of HP calculators. And, most surprising of all, it's only a *partial* list.

Accident Protection

The calculator case is made of acrylonitrile butadiene styrene plastic (ABS), a very tough ter-polymer typically used in football helmets and television cases.

The ABS is specified to combine a high impact rating with a high heat resistance rating.

The cases for the new Series E calculators are made from a polycarbonate/ABS alloy that is even more heat resistant.

> **"My HP-45 was involved in a fire up in the Yukon Territory. After breaking open the case, burned beyond recognition, I found everything to be working in a satisfactory manner."**
>
> **—Letter from an HP owner.**

Even the keys are made out of ABS, though it is unlikely that they would be subjected to high impact.

The top case or keyboard assembly for most calculators is welded to prevent it from coming apart accidentally and to keep out dust and moisture.

The moisture-proof polyester film key-actuator under the keyboard helps protect the inside of the calculator from coffee spills and similar hazards.

Environmental Testing

Before the finished product is introduced, it is submitted to severe environmental testing including droptesting, heat-testing, and salt-spraying.

The calculators are subjected to temperatures higher and lower than the temperatures specified for operating, 32° to 113°F; charging, 59° to 104°F; and storage, −40° to 131°F.

The calculators must withstand 3 g's peak-to-peak vibration at 5-500 Hz.

The calculator is dropped three times on each of its six faces onto hardwood from a distance of one meter—each shock equivalent to 500 g's for one millisecond.

Tests are made to measure susceptibility to static discharge and radiation.

Tests are also made to measure the effect of electromagnetic interference on the calculator and its electromagnetic interference on other devices.

Prototypes of the calculators are tested to withstand two and one-half times their heaviest predicted usage.

Each calculator is also designed to pass safety standards for electrical shock, fire hazard, etc.

Printing Quality

The fully-floating platen in the HP-92 and HP-97 is molded in a precision mold to assure a flat printing surface.

The platen is made of specially-formulated material—polyphenylene sulfide, carbon fiber, and teflon—that withstands high temperature.

It has a deflection temperature of 505°F at 264 psi, that is, the material deflects 0.010 inches at this temperature and pressure.

The carbon fiber is added to dissipate the heat of the print head without melting the surrounding plastic parts.

The teflon is added to cut down the drag on the print head.

Human Engineering

Switches on the calculator slide in a horizontal direction, rather than a vertical direction, to prevent them from moving accidentally when the cal-
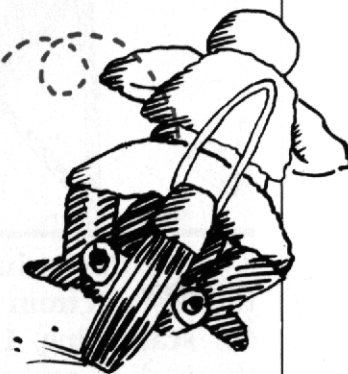
> **"Yesterday while driving to school at 40 miles per hour, my carrying case broke and my calculator went flying to the ground. After locating my HP-45 along the side of the road, I was amazed to see that the unit not only looked OK, but was in perfect operating condition."**
>
> **—Letter from an HP owner.**

culator is placed in your shirt pocket or its carrying case.

The case on handheld calculators is contour-designed to fit the hand comfortably.

The low-level battery indicator is retained on even the least expensive models.

Displays in the new Series E calculators have extra segments to indicate commas in large numbers and error messages.

The battery compartment door is designed to open easily (but not accidentally), without using a coin or key, so you don't have to worry about nicks or, worse, damage that could prevent the door from being easily opened or closed.

The socket for the adapter/recharger plug is recessed to ensure a

"While designing a set of tower stairs from the top of a 40' scaffolding, I felt something slide out of my shirt pocket. I looked down to see my HP-35 hit the concrete floor and come out of the case in several pieces. I climbed down, picked up the pieces, and put them back in the warped case. When I put the battery and all in the case I turned on the switch to find, to my surprise, it worked."

——Letter from an HP owner.

positive connection, so it won't accidentally become loose in the middle of a calculation.

The adapter/recharger plug on the new Series E calculators snaps in to further ensure a positive connection.

Key Quality

Every key is double-injection molded to a tolerance of .002 in. by 50-220 ton plastic molding machines.

The letters are 30 thousandths of an inch in depth.

Keys are pressed 250,000 times.

State-of-the-art plastics technology employs a transducer in the mold to detect the pressure of the plastic inflow to ensure consistent reproduction.

On the HP-92 and HP-97 each key stem is indexed 15° so that a key cannot be placed in the wrong spot on the keyboard.

Silicone is added to the plastic (3% by weight) to help prevent key sticking, and to reduce wear.

During production, keys are inspected dimensionally every four hours and inspected cosmetically on a continuous sampling plan.

All Parts Inspected

All purchased parts, as well as parts fabricated by Hewlett-Packard and subassemblies, pass through Incoming Quality Assurance for inspection and testing.

Each part and subassembly from the recharger cord to the card-reader motor or printing mechanism has its own quality test plan.

The Quality Assurance department employs a continuous multi-level sampling plan based on military standards.

Quality levels are established for all incoming parts, usually tighter than industry standards.
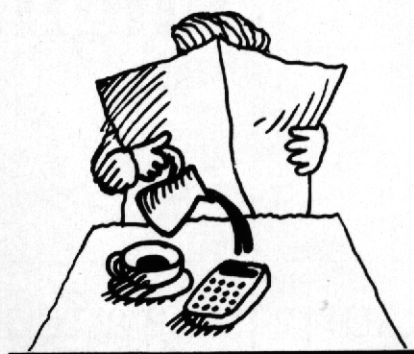
A fixed sample size for a set quality level is tested electrically and mechanically.

A Digital Coordinate Measuring Machine is used in conjunction with a Hewlett-Packard 9830 Desktop Programmable Calculator for fast accurate measurements of mechanical parts.

An X, Y recorder and a Hewlett-Packard 2100 computer are interfaced to a roundness gauge for greater accuracy.
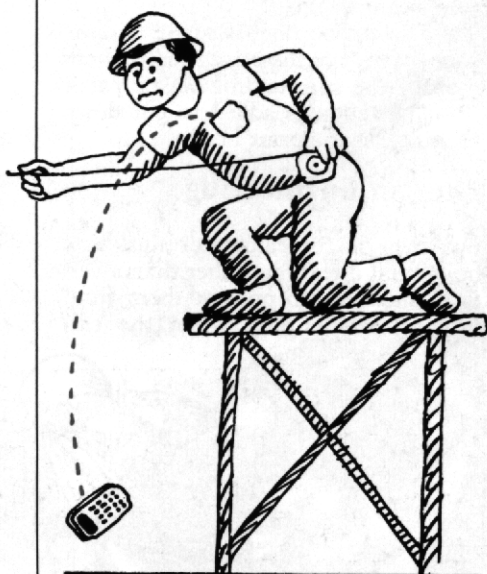
A metrology group from Hewlett-Packard recalibrates the test instruments periodically to maintain accuracy.

All components rejected by production are returned to Incoming Q.A. for testing.

"I have an HP-45. Last week I spilled a cup of coffee on it. Immediately after the accident, the wiring was short circuited with predictable results. The following morning, an order for an HP-67 was in the mill when I gave the HP-45 a last shot. It worked perfectly. Maybe you should build in obsolescence other than technological."

——Letter from an HP owner.

The frequency of defects per part number is monitored.

Inspection procedures are tightened whenever the failure rate on a component is higher than predicted.

Production Testing

The printed circuit boards are tested by a computer during production assembly.

IC's are quickly checked on the new Series E calculators by pressing two keys to initiate the exclusive Series E self-check capability. Pressing another key displays the number of the faulty IC (if any).

LED's are tested through the logic board, as they would be in operation, by lighting every segment of every digit separately, then lighting every digit, and then lighting all the digits together.

Eight calculators at a time are placed in a "buttonpusher" which uses air logic to *exercise* the calculators through a sequence of problems with each answer dependent upon the previous answer.

Production testing is always 100%.

Periodically units are pulled out of finished goods inventory and totally retested by hand as a final quality assurance measure.

The programming advantages of
RPN

For years you've heard us tell you how terrific the RPN logic system is for complex problem solving. We've shown you that it is easier to use, faster, more efficient, more natural, and more versatile than algebraic logic.

Now you're ready to step up to a keystroke or fully programmable calculator and you're wondering which logic system is better for writing programs. The answer? RPN, of course.

All of the advantages of RPN for manual problem solving also apply to programmed problem solving. For most programs, RPN requires fewer keystrokes. You don't need parenthesis keys that waste valuable program memory and you don't need to keep track of complicated hierarchies. And because there are no pending operations to worry about, editing takes less time.

But there is more to it than that. Programming is much more than formula solving. In fact the predominant activity, in most programs, is data manipulation. And RPN with the four-register stack is a logic system designed for easy data manipulation.

Intermediate answers are automatically stored in the stack so you don't waste outside storage registers. And Hewlett-Packard has several data manipulation functions built into its calculators (R↓, x⇋y, and Last x) that you won't find on any algebraic calculator. These functions put you in complete control of the data in your programs.

Overall, RPN lets you slide through the most complicated programs the same easy way it lets you slide through complex calculations—with complete confidence.
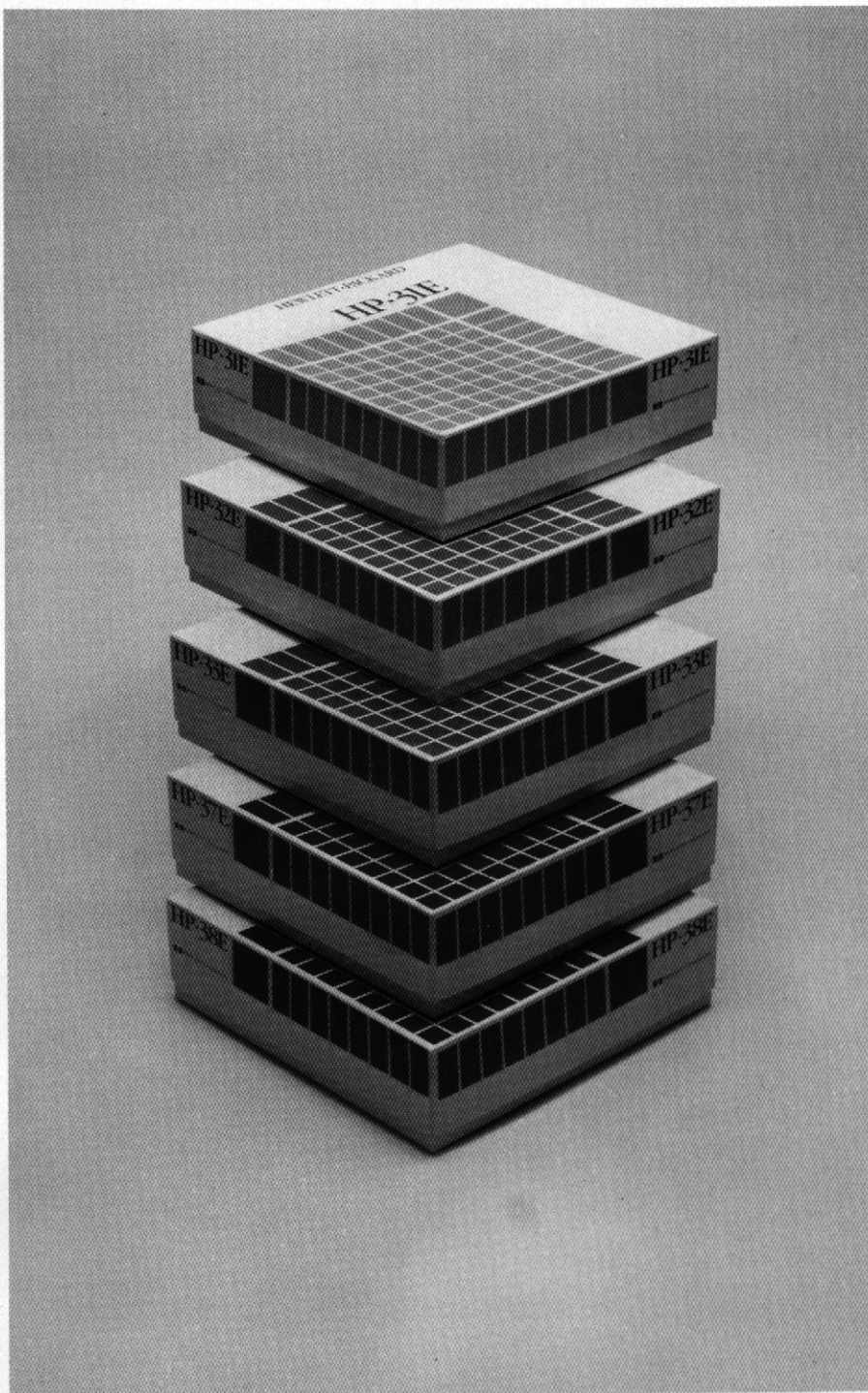
New package design for HP Series E calculators.

A new distinctive packaging system has been designed for all new Hewlett-Packard consumer products beginning with the Series E calculators just introduced.

The major graphic element on the package is a color grid symbolizing a mathematical matrix. This will appear on all product packages, the owner's handbooks, applications pacs and accessory packaging.

The packaging system has been designed to make it easier for you to find the Hewlett-Packard calculator center at your favorite sales location.

Hewlett-Packard introduces a new generation.

Hewlett-Packard's new Series E calculators offer innovative new features at lower prices than any comparable calculators we've ever offered.

New! Error messages tell you when you've made a mistake and even what kind. And if you suspect the calculator, it will perform a diagnostic self-check at the touch of a key.

New! A larger, brighter LED display that automatically separates thousands for easy reading.

New! To help you get started we've prepared modular owner's handbooks, free with the calculator, that let you skip what you already know.

Two features that aren't new are RPN, the most efficient logic system available today, and traditional Hewlett-Packard quality. These instruments are designed—in every detail—to be the finest of their kind in the world.

Try one of them today!
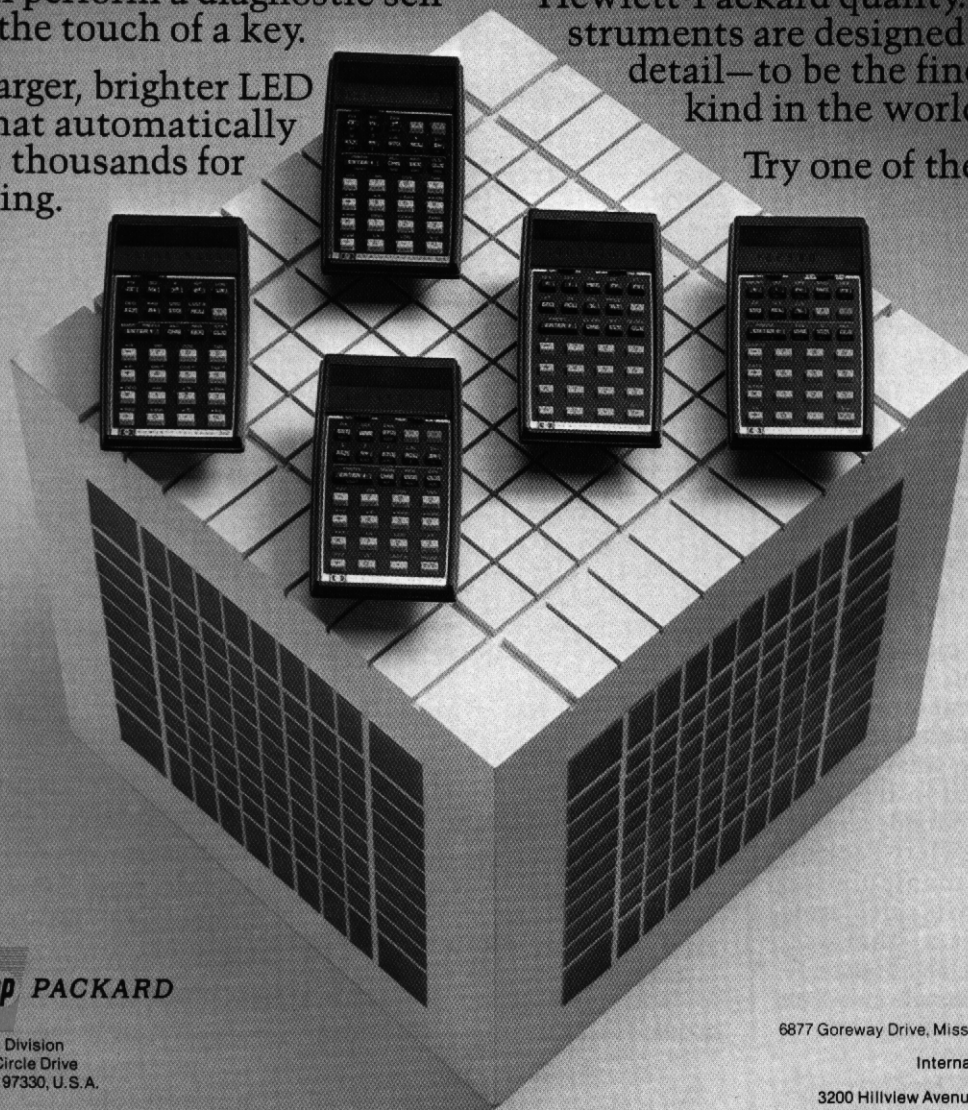
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