HEWLETT-PACKARD

VisiCalc® PLUS

HP-86/87

HEWLETT PACKARD

OWNER'S REGISTRATION CARD

To provide better computer support, Hewlett-Packard needs your help. Your timely inputs enable us to provide higher quality software and **inform you of future modifications or improvements** to this pac.

1. _____
   Name Position

   _____
   Company

   _____
   Address

   _____
   City State

   _____
   Zip Code Phone

2. Type of Business:

01 _____ Agriculture	60 _____ Financial
12 _____ Mining	62 _____ Investment
13 _____ Petroleum	65 _____ Accounting
16 _____ Construction	70 _____ Service
20 _____ Manufacturing	80 _____ Medical
36 _____ Electronics/Computers	81 _____ Legal
40 _____ Transportation	82 _____ Education
50 _____ Wholesale Trade	00 _____ Government
52 _____ Retail Trade	

3. Software Pac Name: _____
   Date Product Purchased: _____ Mo. _____ Day _____ Yr.

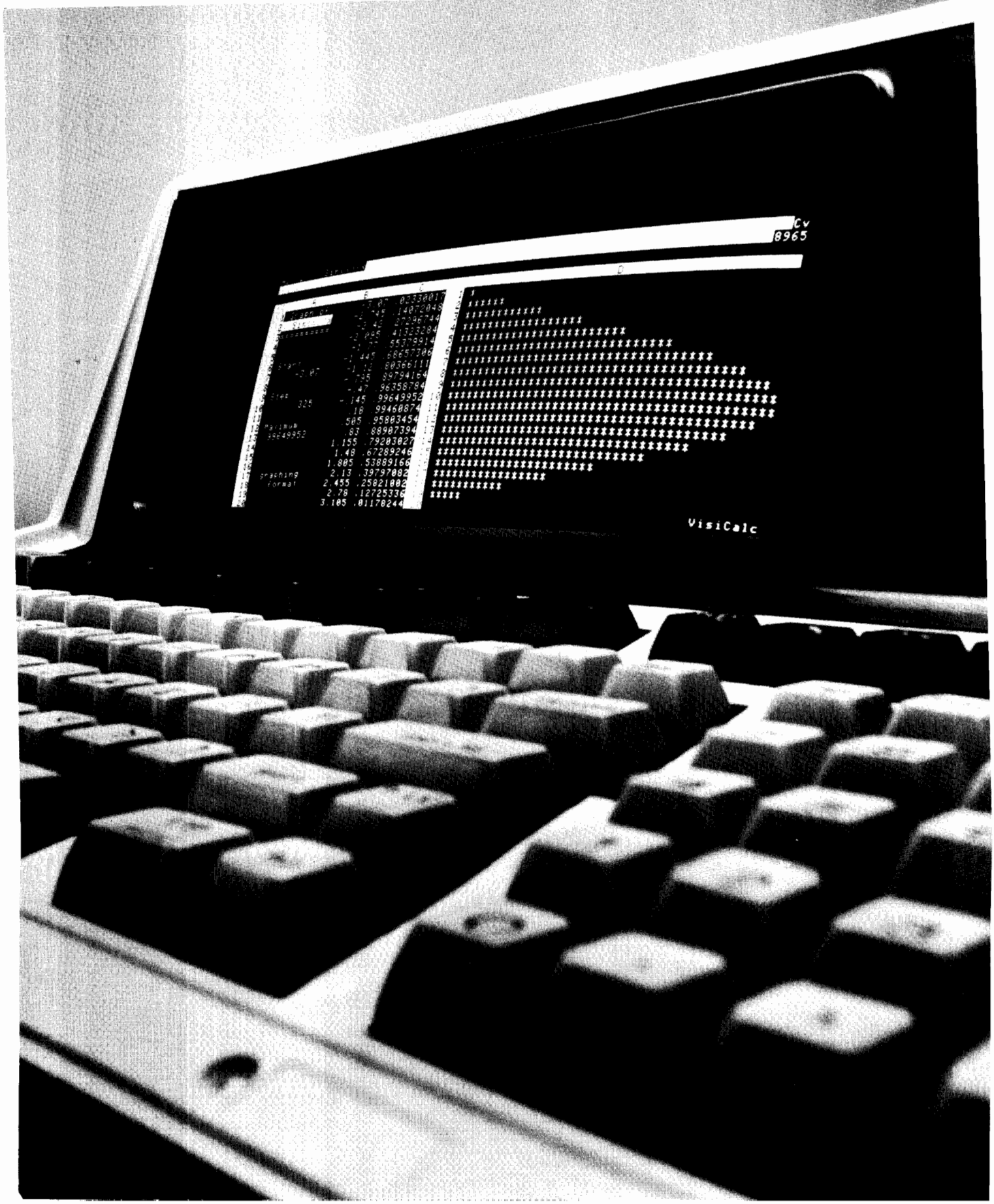
4. How important was the availability of this pac in making your decision to buy a Hewlett-Packard computer?
   - ☐ Would not buy without it
   - ☐ Important
   - ☐ Not Important

5. Rank Salesperson's knowledge of Product
   Poor ☐ Fair ☐ Good ☐ Very Good ☐ Excellent ☐

6. I learned about product through:

☐ Retail Store	☐ Magazine Ad in: _____
☐ Computer Show	☐ Newspaper Ad
☐ Direct Mail	☐ Radio Ad
☐ Another User	☐ TV Ad
☐ Salesperson Called On Me	☐ Other: _____

7. HP Personal Computer Model: _____
   Date Computer Purchased: _____ Mo. _____ Day _____ Yr.


VisiCalc

HP Computer Museum
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Introduction

What Is VisiCalc?

VisiCalc was born of the observation that many problems are commonly solved with a calculator, a pencil, and a sheet of paper—three nearly universal tools. Calculating sales projections, income taxes, financial ratios, your personal budget, engineering changes, cost estimates—even balancing your checkbook are done with these tools.

VisiCalc gives you a way to use your personal computer to solve problems without having to spend time and energy programming. You can use VisiCalc to solve problems, much as you would with a calculator, a pencil, and a sheet of paper. But thanks to VisiCalc's "electronic worksheet" and recalculation capability, you can work more rapidly and explore more options than you could before.

VisiCalc combines the convenience and familiarity of a pocket calculator with the powerful memory and electronic screen capabilities of the personal computer—a better "pencil" and "sheet of paper." With VisiCalc, the computer's CRT screen becomes a "window" which looks upon a much larger "electronic worksheet." You can move or "scroll" this window in all four directions to look at any part of the sheet, or you can split the computer screen into two "windows" to see any two parts of the worksheet at the same time.

The worksheet is organized as a grid of columns and rows. The intersections of the columns and rows define thousands of entry positions (or *cells*). At each of these positions you can enter an alphabetic title, a number, or a formula to be calculated. Just by "writing" on the sheet, you can set up your own charts, tables and records. Formatting commands let you customize the appearance of each entry, row or column. If you wish, for example, you can make your VisiCalc checkbook record look just like the statement you get from your bank.

But the power of VisiCalc is not that it simply imitates a calculator, pencil and paper. The computer actually remembers the formulas and values you've used as you work through a problem. If you change a number you had previously written on the electronic worksheet, all the other related numbers on the sheet change before your eyes, as VisiCalc automatically recalculates all of the formulas.

Recalculation makes VisiCalc a powerful planning and forecasting tool. Not only can you effortlessly correct mistakes and omissions, you can also examine various alternatives. For example, imagine that you are doing sales projections using VisiCalc. You may want to know what the impact on your company will be if a specific product doesn't sell as well as you anticipate. What if you sell only 200 "widgets" a month instead of 250? What if you sell 300? What if one of your salesmen quits and his replacement takes six weeks to come up to speed? Playing "what if" with VisiCalc is simply a matter of changing a single number. Doing the same thing with a calculator, pencil, and paper might take hours of erasing and recalculating.

VisiCalc's editing features also let you change, insert or delete titles, numbers or formulas. When you edit, the VisiCalc worksheet is instantly restructured before your eyes. All of the columns, rows and other formulas are edited to reflect your changes.

If you've entered a formula at one position, VisiCalc lets you replicate it at any number of other positions. VisiCalc will also add up, average, or otherwise alter rows, columns, or other ranges of numbers.

Although you can adjust the lengths of titles and numbers as they are displayed on the CRT screen, the internal length of these titles and formulas can be up to 158 characters. You adjust the lengths of the cell positions on the screen without affecting their contents. To see the complete title, or the formula that produced a number, you simply move the screen highlight, or "cell cursor," to that cell.

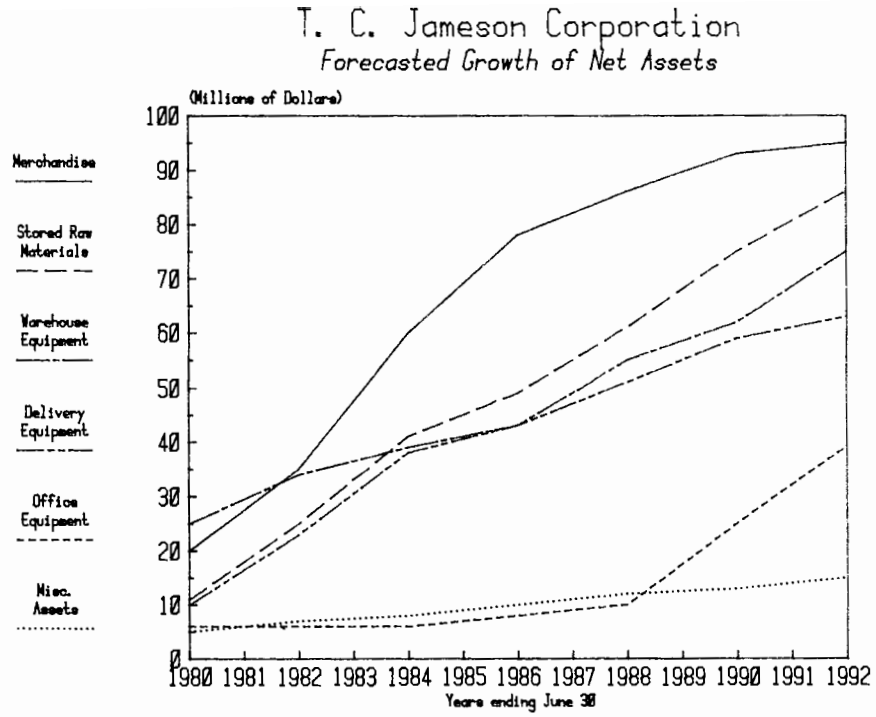
You can save the entire worksheet on a disc. And you can print all or part of the worksheet using a peripheral printer.

The best way to learn to use VisiCalc is to try it. Don't be afraid to experiment and make mistakes. You cannot hurt either the computer or the VisiCalc program, no matter what you type at the keyboard. As you practice, you'll gain familiarity and confidence in using the more advanced features of VisiCalc, which will speed your work still further.

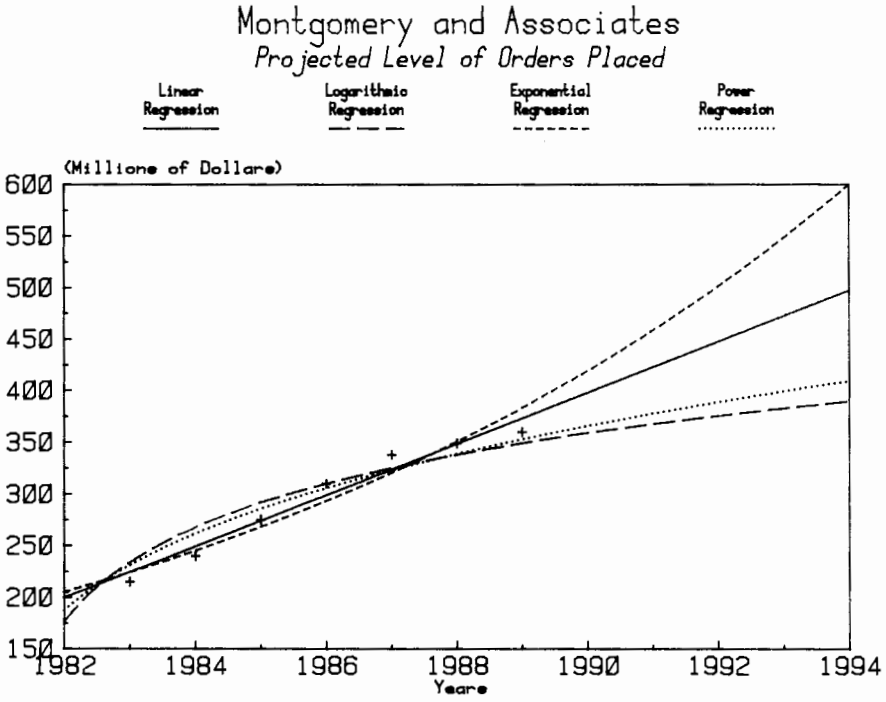
You can learn the elementary features of VisiCalc in an hour or two, and you'll find that you are immediately able to solve simple problems. As you use VisiCalc for more complicated applications, you'll discover that it has a broad range of features and commands. You can learn these features and commands as the need arises. Before long, you'll need only the *VisiCalc PLUS Pocket Guide* which summarizes all of VisiCalc's commands and features.

What Is VisiCalc PLUS?

In addition to the vast electronic worksheet provided by VisiCalc, Hewlett-Packard VisiCalc PLUS also gives you extensive graphing and plotting capability. The PLUS portion of VisiCalc consists of four separate programs. These programs allow you to use information from the VisiCalc worksheet to generate training aids, overhead projector slides, charts, plots, and other highly effective graphic representations of numbers.

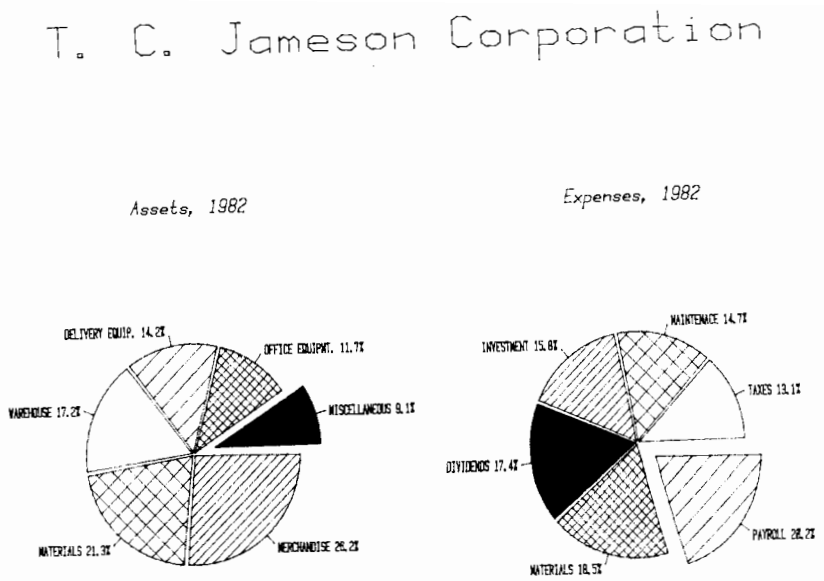


Line Chart

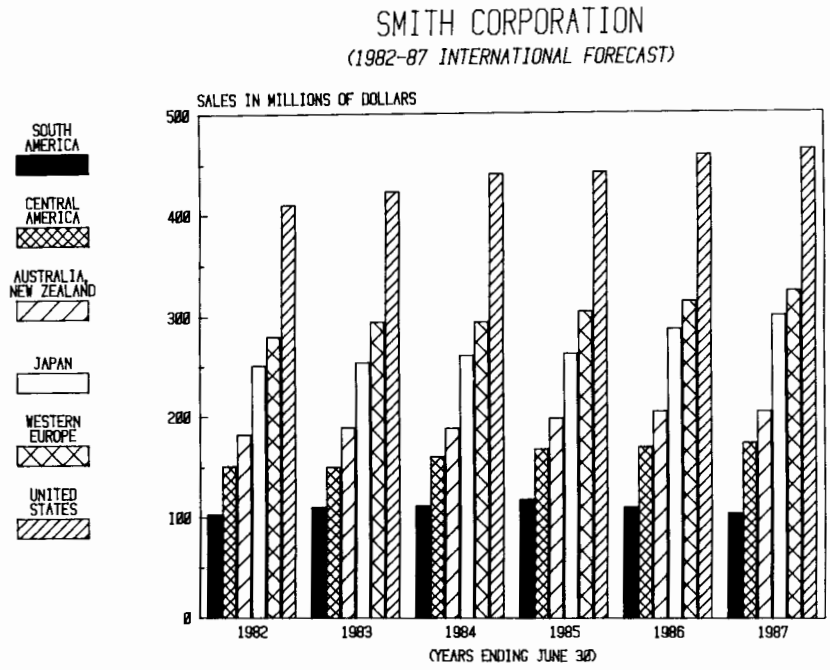


Curve Fit

You can produce line charts with up to six lines, all labeled, on a single graph. Another program lets you perform curve fitting; you can fit up to four standard curves to a set of data points.



Pie Chart



Bar Chart

With a third program, you can convert your data into pie charts, with one or two pies to a chart. And the fourth program creates bar charts, generating normal bars or producing stacks or clusters of bars.

Portions of your graphs can be clear or shaded, single-hatched or cross-hatched, labeled with slanted or upright, upper- or lower-case letters. A choice of eight plotter pen colors makes your graphs colorful and helps you easily identify each bar, slice, curve, or line. Graphs can be created either on a peripheral plotter or on your computer's display screen.

Together, VisiCalc and the four PLUS programs change your personal computer into a vast, graphable electronic worksheet.

The VisiCalc PLUS Package

Besides this manual, Hewlett-Packard HP-86/87 VisiCalc PLUS also comprises a pocket guide and a disc for use with an HP-86/87 Personal Computer. The disc contains the following prerecorded programs and data.

- VZCALC: A binary program that is the main VisiCalc program.
- VZLINE: A BASIC program that uses VisiCalc data to graph line charts.
- VZCURV: A BASIC program that allows you to fit standard regression curves to VisiCalc data.
- VZPIE: A BASIC program that uses VisiCalc data to plot pie charts.
- VZBAR: A BASIC program that uses VisiCalc data to create bar charts.
- LINCURg: A binary program that is automatically loaded and executed by the four graphics programs.
- REDZERg: A binary program that is automatically loaded and executed by VZLINE, VZCURV and VZBAR just like LINCURg.
- XYZ: A data file containing a ten year earnings forecast for the mythical XYZ Corporation. This data file is used in the examples of graphing.
- VZREAD: A BASIC program that allows you to read data files created by VisiCalc.
- VZWRITE: A BASIC program that allows you to create VisiCalc data files from numeric arrays.

Contents

Section 1

Getting Started

This section shows you how to put the power of VisiCalc to work. All you need to begin are:

- An HP-86/87 Personal Computer. (A flexible disc drive must be attached.)
- HP-86/87 VisiCalc PLUS, part number 00087-13001 which consists of this manual, the *HP-86/87 VisiCalc PLUS Pocket Guide*, and a disc containing the VisiCalc PLUS programs.

Besides the programs on the disc provided with VisiCalc PLUS, you will need other items in order to create graphs of VisiCalc data. Here is a table summarizing the equipment needs of the HP-86/87 when running the programs to create graphs:

Equipment Requirements

	VisiCalc	VisiCalc PLUS
HP 82900 Series Disc Drive	R	R
HP 82907 32K Memory Module	O	R
HP 82936A ROM Drawer	O	R
HP 00087-15002 Plotter ROM	O	R
HP 7225, 7470, 9872, or an equivalent plotter	O	O
HP 82905B Printer	O	O
Peripheral interconnect cables	R	R

(O = optional, R = required)

Note: VisiCalc requires no external memory modules. However, 32K, 64K, and 128K memory modules may be installed to increase the worksheet size. The PLUS programs require at least 32K of external memory. Also, any printer that is compatible with the HP-IB (Hewlett-Packard-Interface Bus), HP 82939A Serial Interface module, or HP 82940A GPIO Interface module can be used.

This manual deals only with the use of VisiCalc PLUS on the HP-86/87 Personal Computer. Plotter ROM error messages are listed and explained in the HP-86/87 owner's manual. For more in-depth information about any part of the HP-86/87 itself, refer to the owner's manual or other HP-86/87 literature.

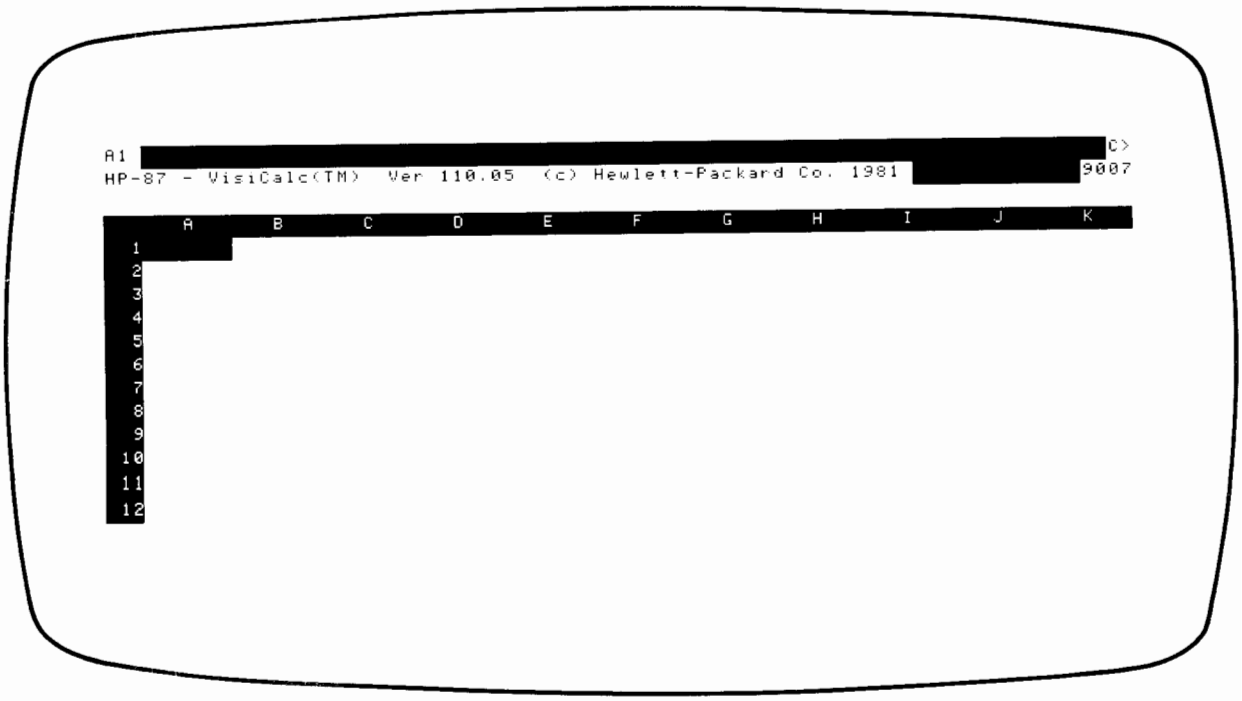
If you have extensive experience with HP VisiCalc you will not find it necessary to read this entire manual. Appendix B will provide information about the new and modified features of HP-86/87 VisiCalc. However, if this is your first experience with VisiCalc, you should read this manual carefully and follow the examples.

Loading the VisiCalc Program

VisiCalc, the program which converts a Hewlett-Packard Series 80 Personal Computer into an "electronic worksheet," is contained on the disc that accompanies this manual. To load the VisiCalc program into the computer insert the VisiCalc disc into drive 0 of the disc drive and do the following:

1. Type LOADBIN "VZCALC"
2. Follow the command with (END LINE).
3. When the program is loaded (the disc drive light will go out), type VC and press (END LINE). You should see the following VisiCalc display on the CRT screen.

VisiCalc Display



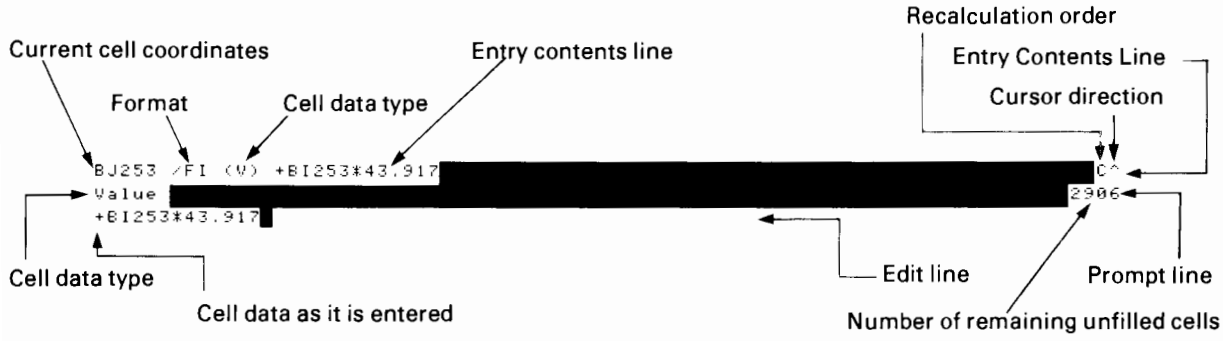
At this point, the VisiCalc program is loaded into the computer's memory, so you may remove the VisiCalc disc if you like. Or you can leave the disc installed or install another disc for storing your worksheet later.

The VisiCalc Display

Your CRT screen has become a window into the computer's memory, which VisiCalc has organized like an electronic worksheet. As you can see, the sheet is divided into rows which are numbered 1, 2, 3, and so on, and columns which are lettered A, B, C, and so on. At each intersection of a row and column there is a now-invisible entry position, or *cell,* with coordinates such as A1, B3, C17, etc. At each cell position you can "write" a message or title, a number, or a formula of the kind you might enter, keystroke by keystroke, on a calculator. In a moment we'll demonstrate how to move around and write on the sheet.

Above the rows and columns is the VisiCalc status area, three lines which give you information about the status of VisiCalc. Although not all parts of the three status area lines are visible right now in the CRT display on your computer, here is an example that shows the parts of the status area:

VisiCalc Status Area



The top status area line is the *entry contents line.* It can contain:

- Current cursor coordinates (A1 when program is cleared, also called the "home" position).
- Cell data format code: /F if a local code is set (optional).
- Cell data type: (V) for value, (L) for label, (/−) for repeating label.
- Cell data: value, expression or label. A maximum of 70 characters out of 158 characters may appear.
- Recalculation order: C for column priority, R for row priority. The symbol is highlighted during each recalculation.
- Cursor direction indicator: < left, > right, ^ up, v down.

The second status area line is the *prompt line.* It can contain:

- Cell data type, command prompt, or edit prompt.
- Number of unfilled cells remaining for use. (The number in your prompt line may differ from the numbers shown in the displays in this manual.)

The third status area line is the *edit line.* It contains cell data as you're entering or editing it.

The usefulness of the status area will become more apparent to you as you learn more about VisiCalc.

Moving the Cell Cursor

Examine the display on your computer again. In the upper left corner of the status area, at the left edge of the entry contents line, you can see the coordinates A1 displayed. Notice that there is also a white box in the entry position at column A, row 1. This highlight is called the *cell cursor.* You write on the worksheet at the cell position marked by this cursor; you can think of it as the point of your pencil or pen.

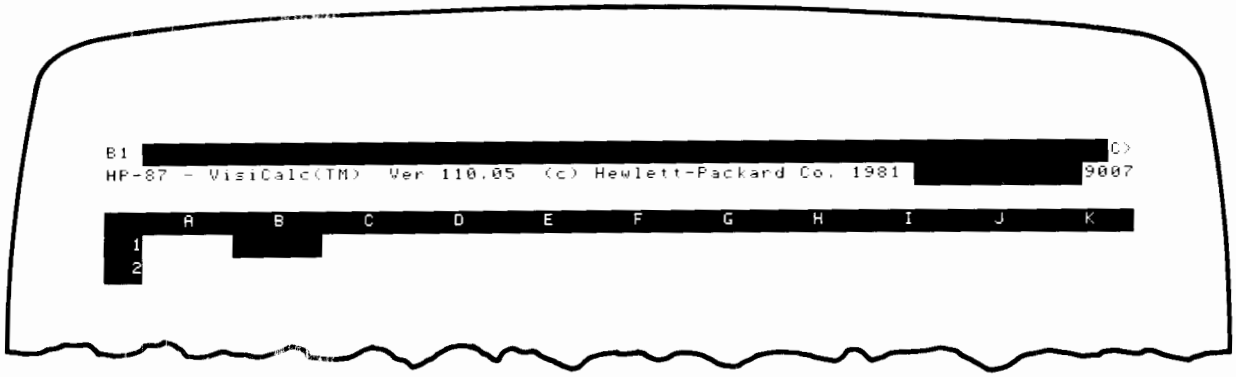
Using the Cursor Keys

You can move the cell cursor around the VisiCalc worksheet in much the same way as you move the normal computer cursor—by using the ↖, ↑, ↓, →, and ← keys.

Try pressing the right arrow key, →, once.

Press →

VisiCalc Display



Notice that the cell cursor moves to the cell position at column B, row 1, and that the cell cursor coordinates at the left edge of the status area entry line change to B1. Also, notice that the pointer at the right edge of the entry contents line indicates the direction the cell cursor has moved.

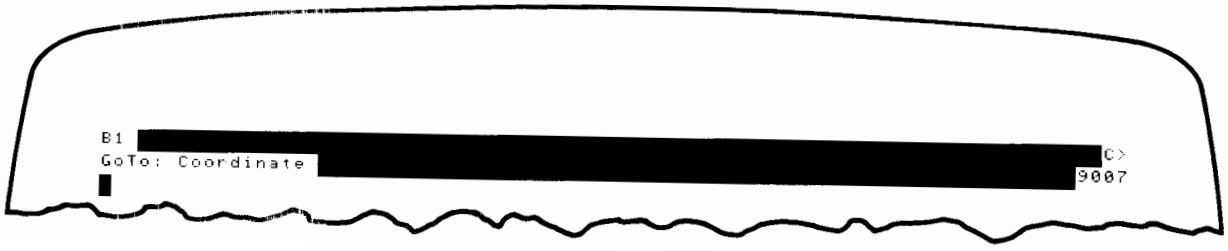
You can use the cursor movement keys to move the cell cursor in any direction. For repeated moves in the same direction, hold the key down.

Using the GOTO Key, >

Another way of moving the cell cursor is by pressing SHIFT >, followed by the coordinates of the cell you want to move the cursor to. For example, to move the cell cursor to cell D3:

Press SHIFT >

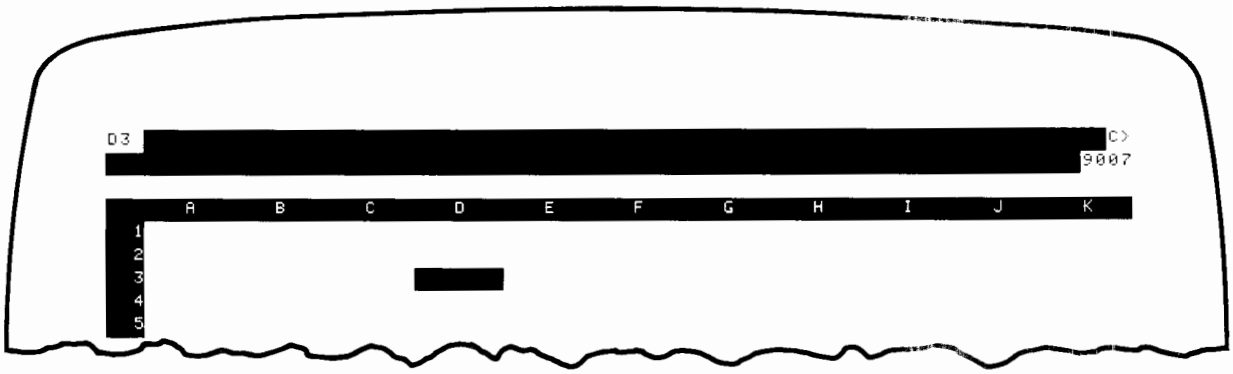
VisiCalc Status Area



The prompt line of the status area asks for the coordinates of the destination, and another cursor, the *edit line cursor*, appears on the edit line. To continue:

Press D3 (END LINE)

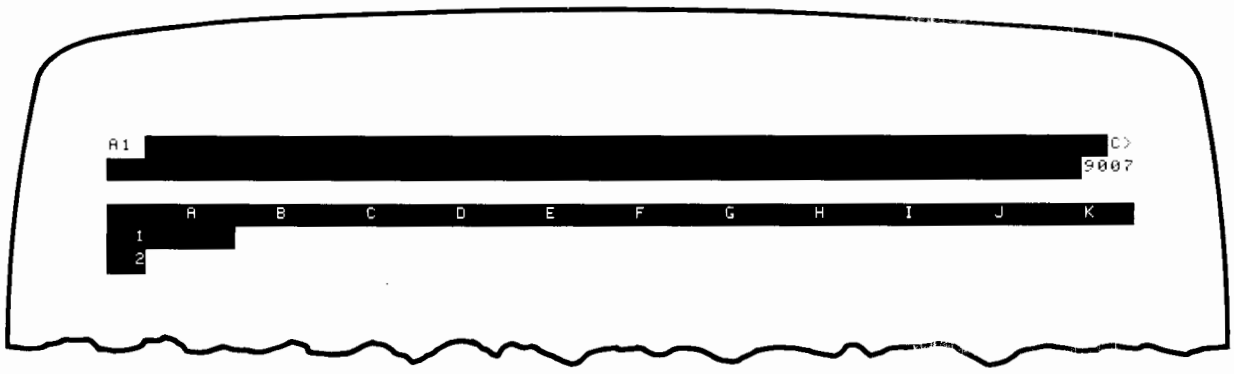
VisiCalc Display



To return the cursor to position A1, you can use (>) A1, you can use the (↑) and (←) keys, or use the (↖) key.

Press (SHIFT) (>) A1 (END LINE)

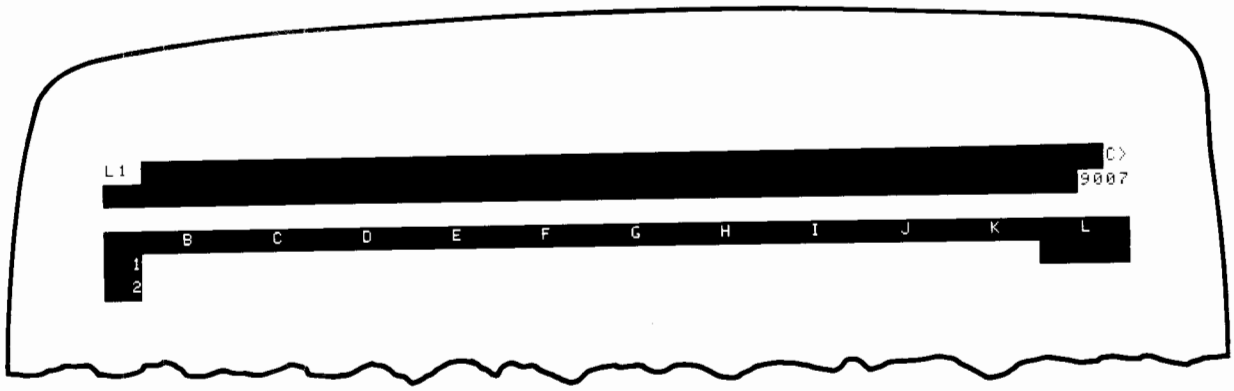
VisiCalc Display



When you first load VisiCalc, your worksheet window is positioned to let you look at the upper left-hand corner of the VisiCalc worksheet. The window allows you to see the first eleven columns (A through K) and the first twelve rows (1 through 12) of the sheet. Now, with the cursor at A1, press the right arrow key, (→), ten times. Then press (→) again.

Press → → → → → → → → → → →

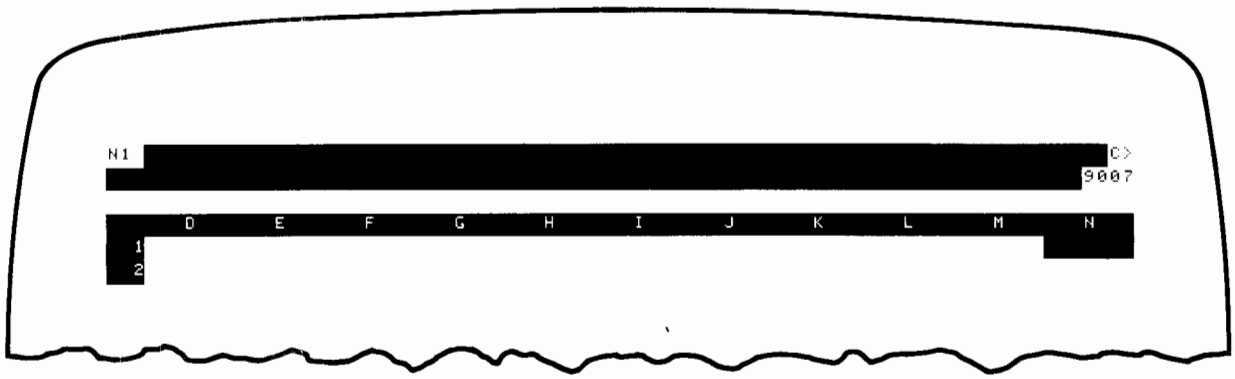
VisiCalc Display



The cell cursor moves to cell L1 and column L of the worksheet comes into view, while column A disappears off the left edge of the window. When this happens, we say that the window has "scrolled" to the right. Try pressing → two more times to bring columns M and N into view:

Press → →

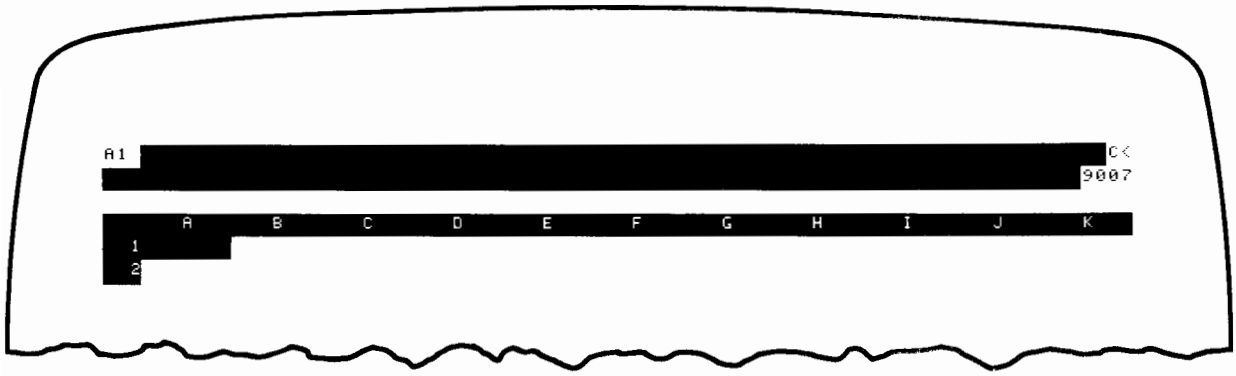
VisiCalc Display



The screen window will also scroll to the left; in fact, it will scroll in all four directions. Press the left arrow key, ←, and hold it down until the cell cursor is again at position A1. Continue pressing and listen to the beeps as the cell cursor "bumps" against the margin of the worksheet.

Press and Hold ←

VisiCalc Display



Editing With BACK SPACE

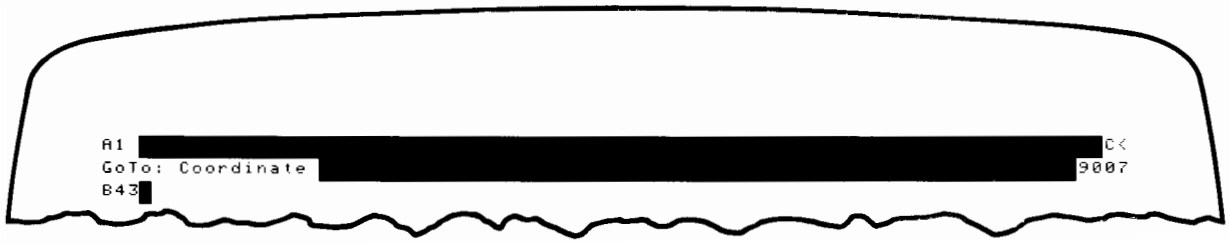
If you have made any typing errors up to this point, you've had no way to correct them. VisiCalc has several error correction features, but the one you'll first want to become familiar with is the BACK SPACE key.

As you are typing entries into VisiCalc, BACK SPACE allows you to change anything that is shown on the edit line. You can change a wrong keystroke, or you can hold BACK SPACE down and erase the entire line. If you press BACK SPACE again, VisiCalc even backs out of the entry mode it's in. (Pressing SHIFT BACK SPACE clears the entire line *and* the entry mode.)

For example, suppose you wanted to move the cell cursor to cell B3, but you press B43 instead, resulting in B43 on the edit line:

Press SHIFT > B43

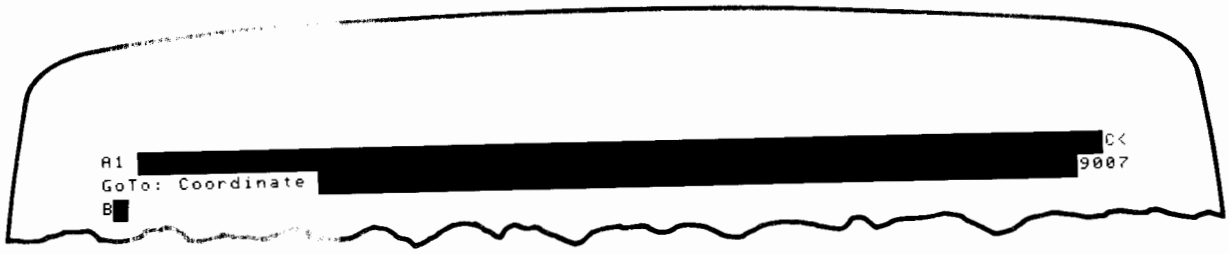
VisiCalc Status Area



To back up and erase the B43 on the edit line, just press BACK SPACE enough times to clear the unwanted characters:

Press BACK SPACE BACK SPACE

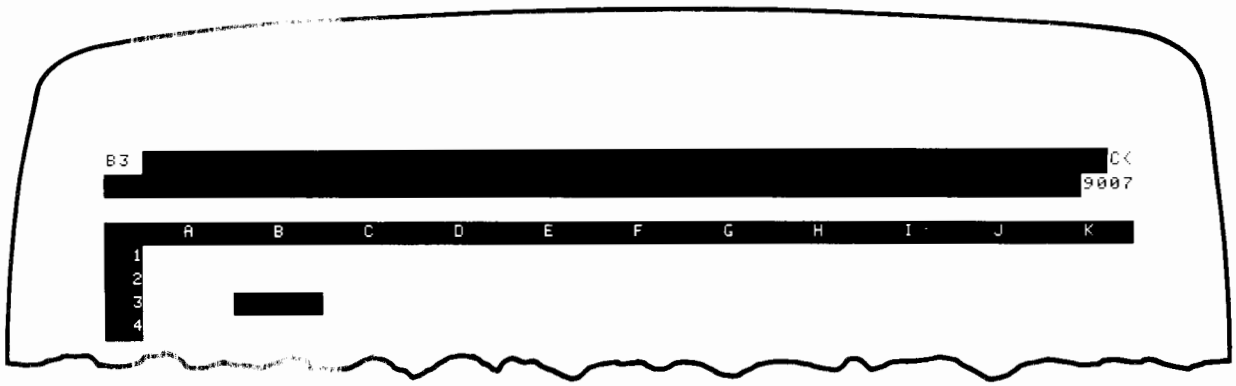
VisiCalc Status Area



Then continue with the correct entry:

Press 3 END LINE

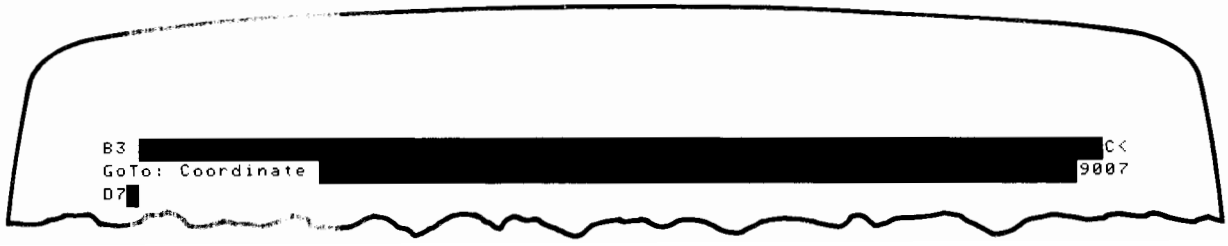
VisiCalc Display



Besides backing up, you can use BACK SPACE to "back out" of a VisiCalc entry or command. For example, suppose you start to move the cell cursor to cell D7:

Press SHIFT > D7

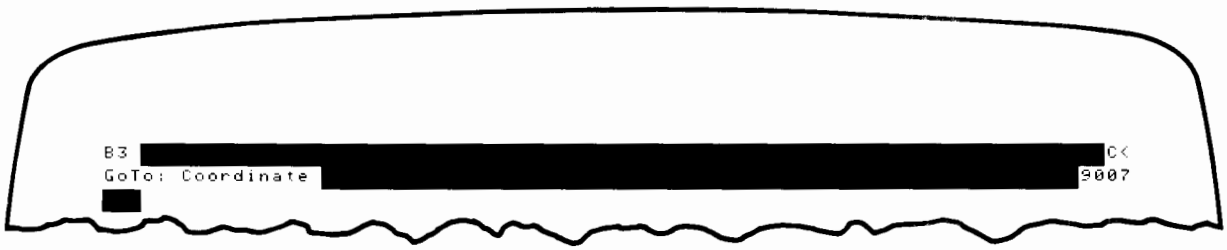
VisiCalc Status Area



Then you decide not to move the cell cursor at all. Just press (BACK SPACE) once to clear the cell coordinates, then press (BACK SPACE) once more to move out of the "GOTO" mode entirely:

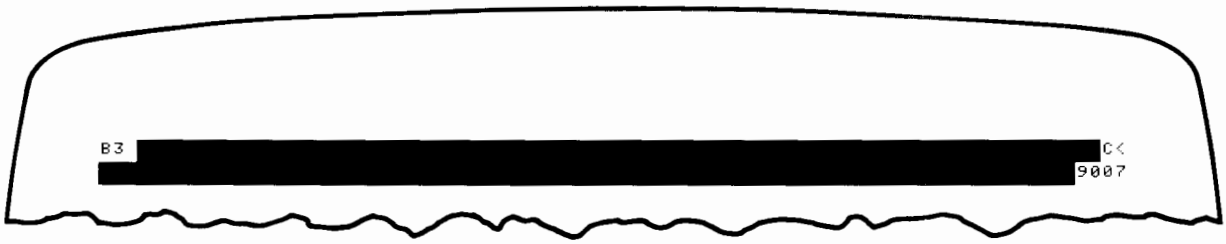
Press (BACK SPACE) (BACK SPACE)

VisiCalc Status Area



Press (BACK SPACE)

VisiCalc Status Area



You could have accomplished the same thing by pressing (SHIFT) (BACK SPACE).

No matter what you are typing, you can always back out and leave the worksheet unchanged by using (BACK SPACE), as long as you notice your error before pressing (END LINE) or otherwise terminating your entry.

In addition to (BACK SPACE), VisiCalc has other editing controls. These are explained later in this manual.

VisiCalc Operational Modes

When you first load the VisiCalc program, or if you clear the worksheet, VisiCalc is set to *top-level* mode; from this mode you can switch to *command* mode, *data entry* mode, or *edit* mode. The operation of some of the computer keys differs in different modes, and in most cases you must return VisiCalc to top-level before selecting a new mode.

In practice, you will seldom have to worry about what mode VisiCalc is in. VisiCalc automatically switches between modes as required, leaving you free to enter data, execute commands, or perform editing. When you signal to VisiCalc that you're through with an operation (by terminating an entry with (END LINE), "backing out" of a command, etc.), the program automatically returns to top-level mode, ready for a new entry or command.

Cells and Cell Contents

In order to "write" on the VisiCalc worksheet, you simply set the cell cursor to the desired location, then key in the cell contents from the keyboard. If you make a mistake while typing, you can use [BACK SPACE] to correct your error.

As you type characters, move the cursor, etc., you don't have to worry about "losing" keystrokes, even if you type very rapidly. VisiCalc has a keystroke buffer that remembers the keys you press and ensures that they are executed.

A VisiCalc cell can contain up to 158 characters. When you write into a cell entry position, the first character typed determines whether the entry will be interpreted by VisiCalc as a *label* or a *value.*

Labels

Labels are usually used as column or row headings, or to title or explain the information and calculations on the VisiCalc worksheet. VisiCalc interprets a cell entry as a label if the first character keyed in is an upper- or lower-case alphabetic character (A through Z, or a through z), a quote character ["], a single quote character ['], or the space bar.

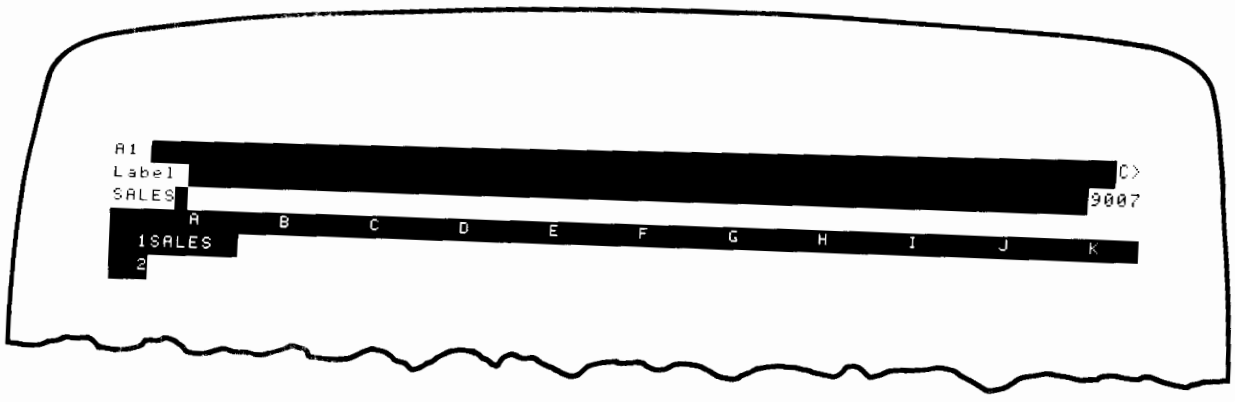
VisiCalc looks at only the first character of a cell entry to determine whether the entry is a label or a value; after the first character has set label mode, you can use any of the computer's 128 characters, including numbers and mathematical expressions, as part of a label.

To place the label SALES in cell A1, you simply type the word and terminate the entry either by pressing [END LINE] or by moving the cell cursor to an adjacent position.

Let's type the word SALES into cell A1, examining the cell and the VisiCalc status area as we proceed:

Press [SHIFT] [↖] SALES

VisiCalc Display



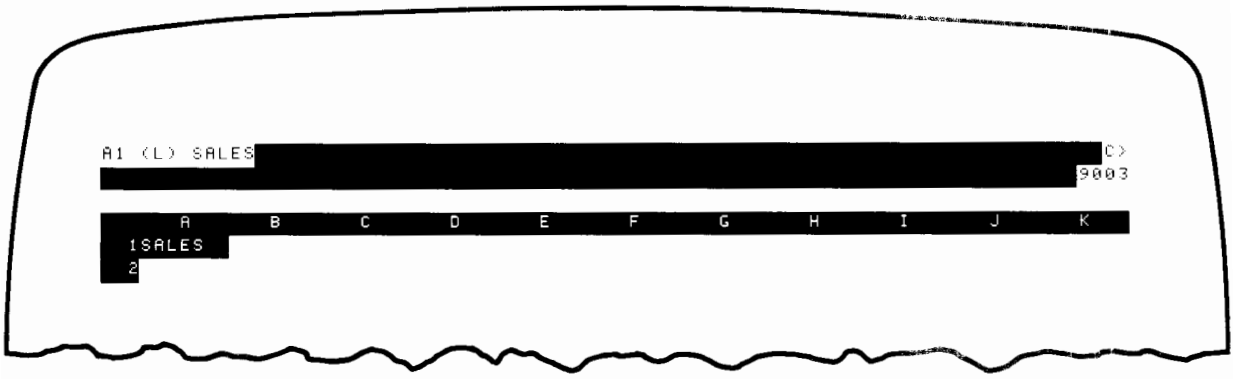
Notice that the word SALES is present on the edit line, as well as in the cell, indicating that the entry hasn't been terminated and that you can still add to or edit the word.

The prompt line shows that SALES is a *label,* not a mathematical value.

Now terminate the entry by pressing (END LINE):

Press (END LINE)

VisiCalc Display



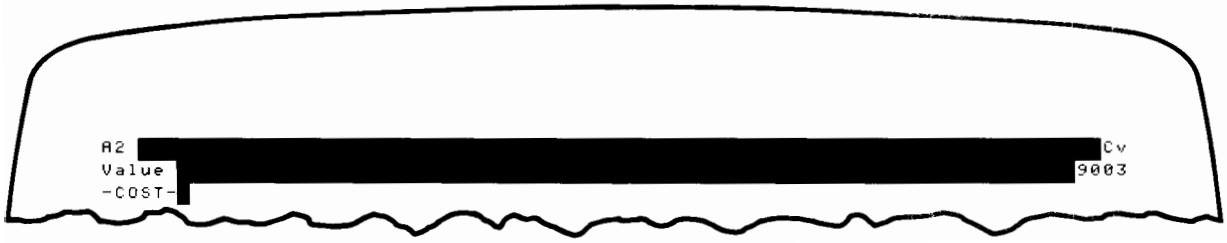
Now cell A1 contains the label SALES. The entry contents line reflects the contents of the cell (L for *label*), and the prompt line and edit line are ready for a new entry. Notice also that the status area shows a decrease in the number of remaining empty cells, indicating that memory has been allocated for the entry.

If you attempt to type in a label but precede it with a value character, such as (-), ({), or a digit, VisiCalc assumes that you are typing in a value, and the label will not be accepted by the computer. Using the single quote symbol, ('), as the first character keyed in tells VisiCalc that the expression is a label, no matter *what* else follows. (The (') does not appear in the final expression, and no closing quote symbol is needed.)

For example, let's try to type a label for cost at the beginning of the second row, in cell position A2. But we'll precede the label with a dash, —.

Press (↓)—COST— (END LINE)

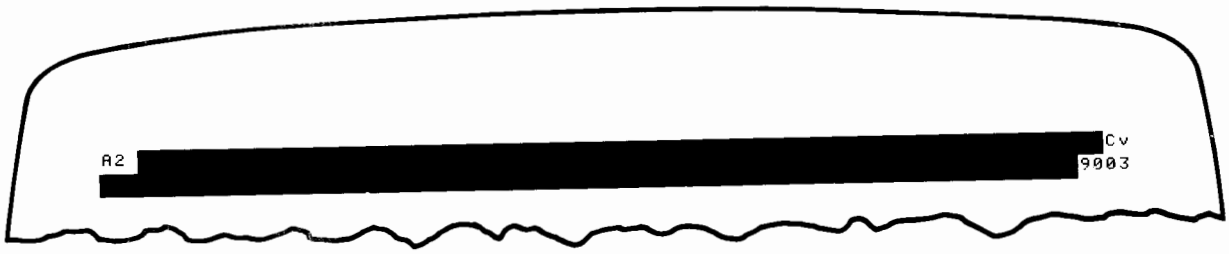
VisiCalc Status Area



The computer beeps to indicate an error, and the entry is not accepted. Now use BACK SPACE to clear the error, and precede the label —COST— with a single quote symbol, '. Repeated pressings of the BACK SPACE key will clear the error, but using SHIFT BACK SPACE is easier in this case:

Press SHIFT BACK SPACE

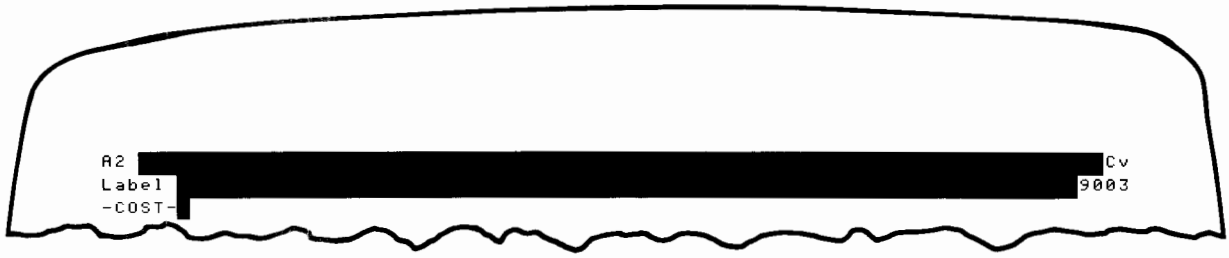
VisiCalc Status Area



The error is cleared, and VisiCalc is ready for a new entry.

Now Press '—COST—

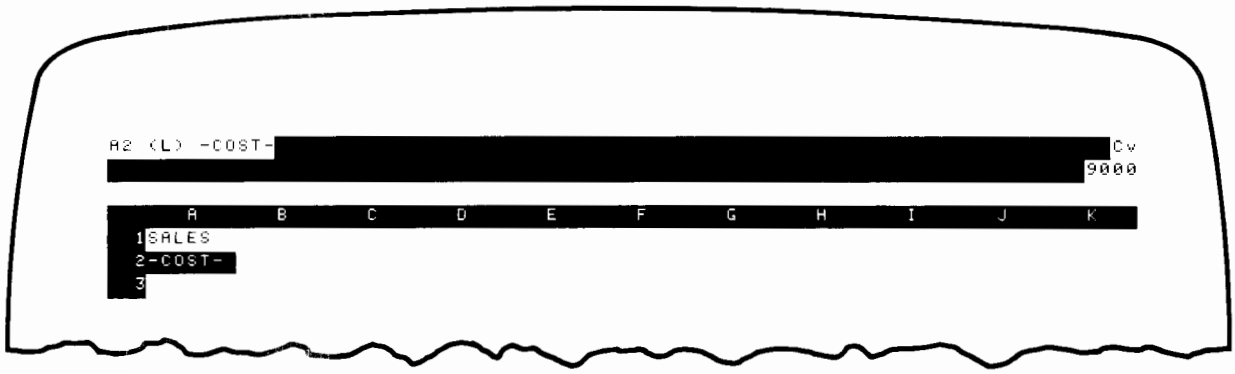
VisiCalc Status Area



The single quote symbol, ', told VisiCalc that you were typing in a *label.* To see if the label is accepted now:

Press END LINE

VisiCalc Display



As you can see, the label, —COST—, appears in cell A2, and the entry contents line shows the label as you typed it in.

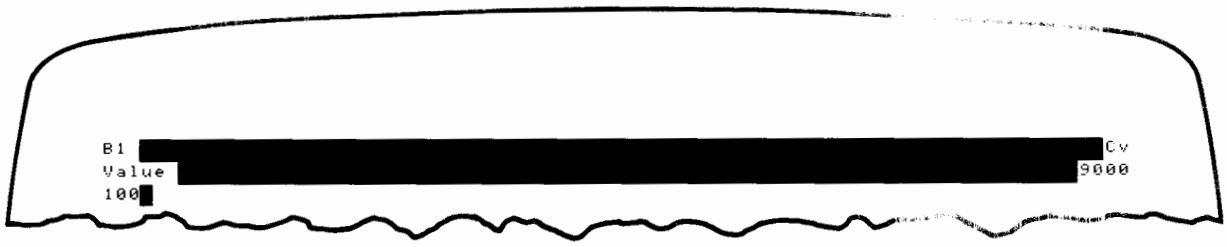
Values

Values may be thought of as the actual numerical entries on the VisiCalc worksheet. A value entry is an expression or formula consisting of numbers, arithmetic operators such as + and *, parentheses, functions, or value references (that is, cell coordinates which refer to the values of other cell expressions).

Example. Let's write a value for *sales* in column B. Move the cell cursor to cell B1 and enter a value representing $100:

Press (SHIFT) (>) B1 (END LINE) 100

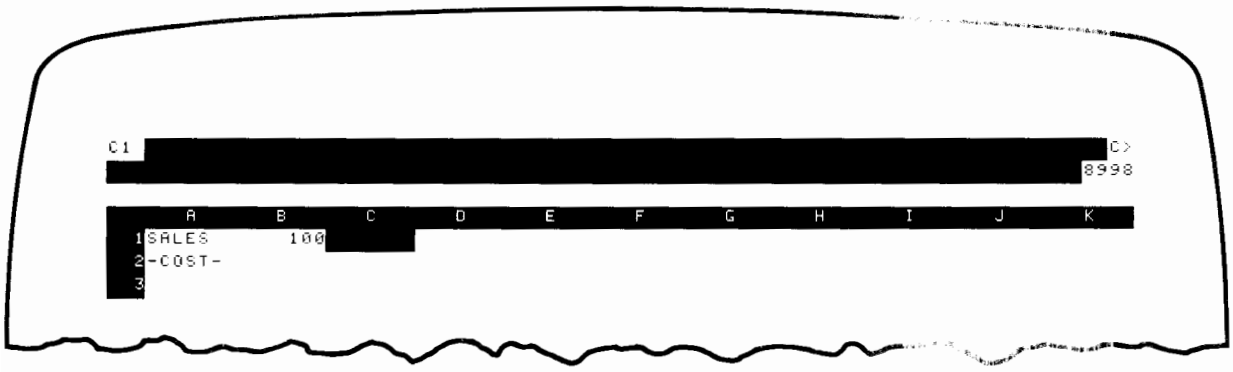
VisiCalc Status Area



As soon as you pressed the first number key, VisiCalc immediately knew that the entry was to be a *value*. When you now terminate the entry (by pressing (END LINE) or moving to another cell) the value appears in cell B1:

Press (→)

VisiCalc Display



Formulas

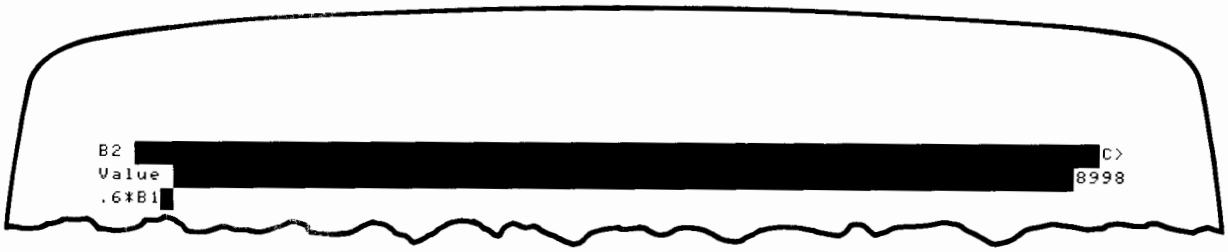
The real power of VisiCalc is its ability to have the contents of one cell calculated using the contents of another—or of several others. By using as a cell value a formula which depends on another cell, and that cell on another, etc., you can play "what if", changing the entire worksheet by altering only a few values.

To use the value of one cell as a part of a formula in another, simply include the first cell's coordinates in the formula of the second cell. In order for a cell entry to be a calculated *value,* it cannot begin with an alphabetic character or the quote symbol. (A reference to a cell that contains a *label* will be evaluated as a zero.)

Example. To set up a second row, *cost,* which is 60% of *sales,* you would use the value in cell B1 as part of the *cost* formula. We want the entry for *cost* at cell B2 to be 60% of the value for *sales* given in cell B1. So we use B1 as part of the formula in B2:

Press (SHIFT) (>) B2 (END LINE) .6 * B1

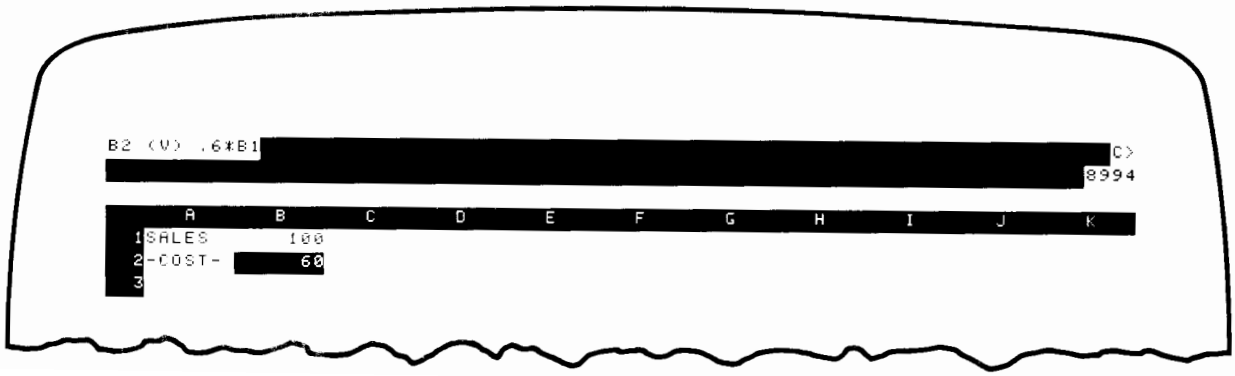
VisiCalc Status Area



When you terminate the entry using (END LINE), the entry contents line shows the formula, .6 * B1, that is used to calculate the value in cell B2. The number 60 is at cell B2 on the worksheet. This is the result of multiplying .6 by 100, the number in cell B1:

Press (END LINE)

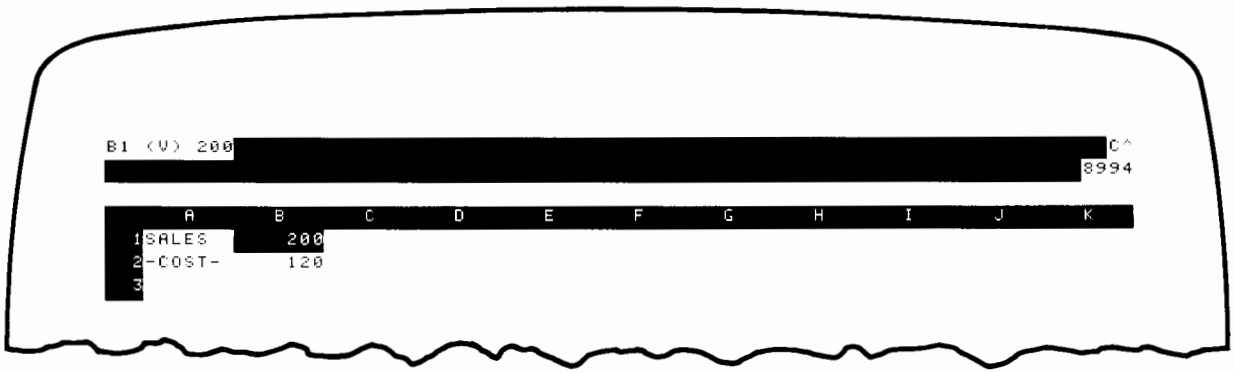
VisiCalc Display



If you change the value in cell B1 now, the contents of B2 will also change, since B2's formula depends on the value in cell B1:

Press ↑ 200 END LINE

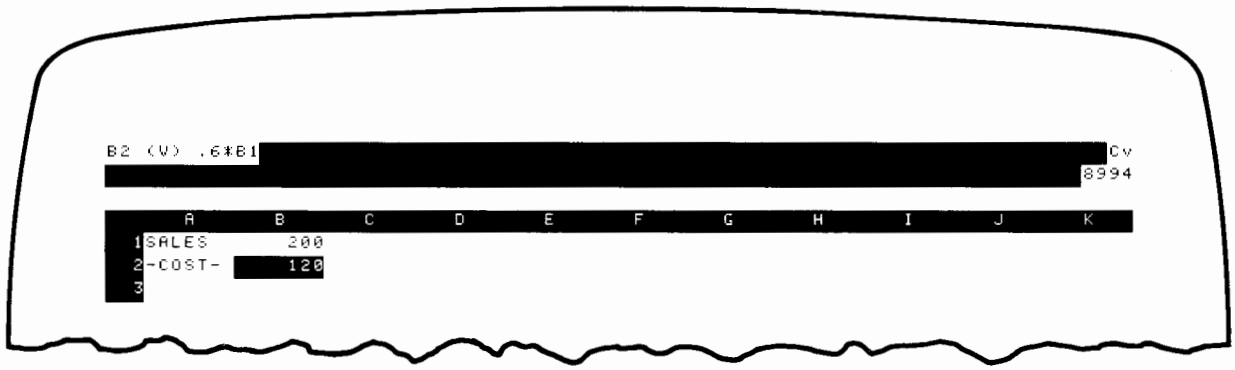
VisiCalc Display



Notice that when the number in cell B1 was changed to 200, the number in cell B2 automatically became 120. *Cost* is still 60% of *sales*. You can see that the formula used to calculate the contents of B2 has not changed:

Press ↓

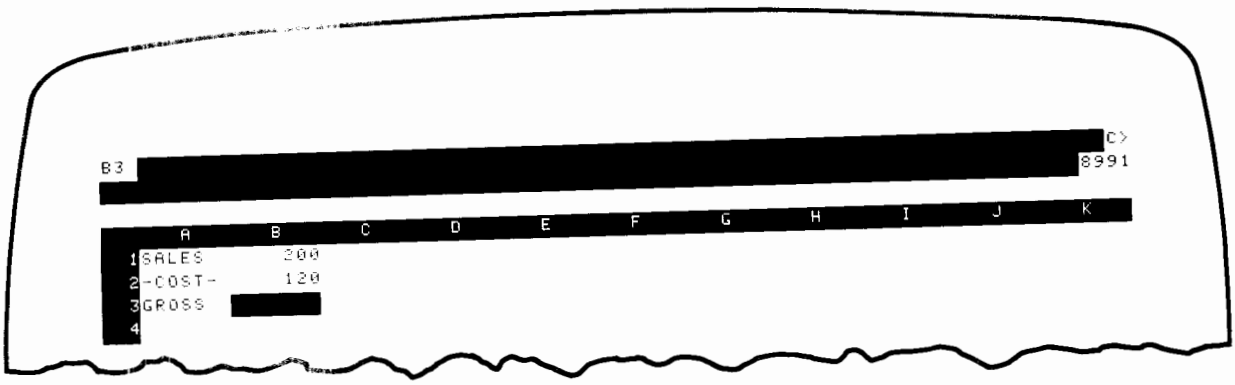
VisiCalc Display



Now let's create a third row, one that will calculate *gross* as the difference of *sales* and *cost*. First, give the row the label GROSS:

Press (SHIFT) (>) A3 (END LINE) GROSS (→)

VisiCalc Display



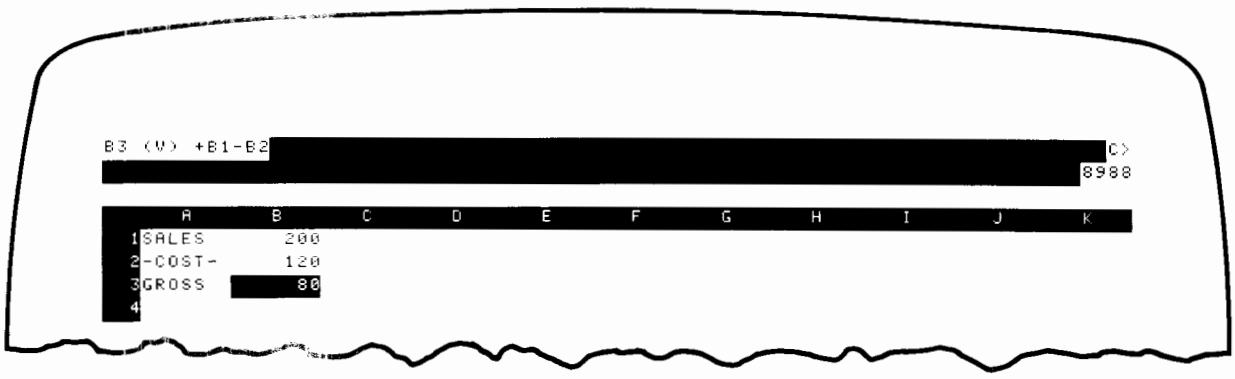
Now, for the value of *gross* that will appear in cell B3, we need to calculate *sales* minus *cost*: that is, B1 – B2.

But remember how VisiCalc determines whether you are typing a label or a value. It looks at the first character typed in—and the first character of B1 – B2 is an alphabetic character, B. B1 – B2 is a perfectly legitimate message or comment, but it doesn't calculate anything. If you typed B1 – B2 into cell B3, you would not have the result of calculating *sales* minus *cost*, but simply a label.

Remember that we used the (') key to type a label when VisiCalc would otherwise have tried to treat it as a value. We can use a similar trick to type the formula B1 – B2 as a value, instead of a label. One way to do this would be to type the formula as 0 + B1 – B2. VisiCalc would take the initial digit, 0, to signify that we were typing a value. An equivalent formula is + B1 – B2; VisiCalc will take the '+' to indicate a value:

Press + B1 – B2 (END LINE)

VisiCalc Display



Now we have what we want. The entry contents line tells us that the cell cursor is set to cell position B3, that there is a value there, and that the formula for the value is + B1 − B2. In the cell position itself is the number 80, the result of evaluating B1 − B2, or 200 − 120.

Terminating a Label or Value Entry

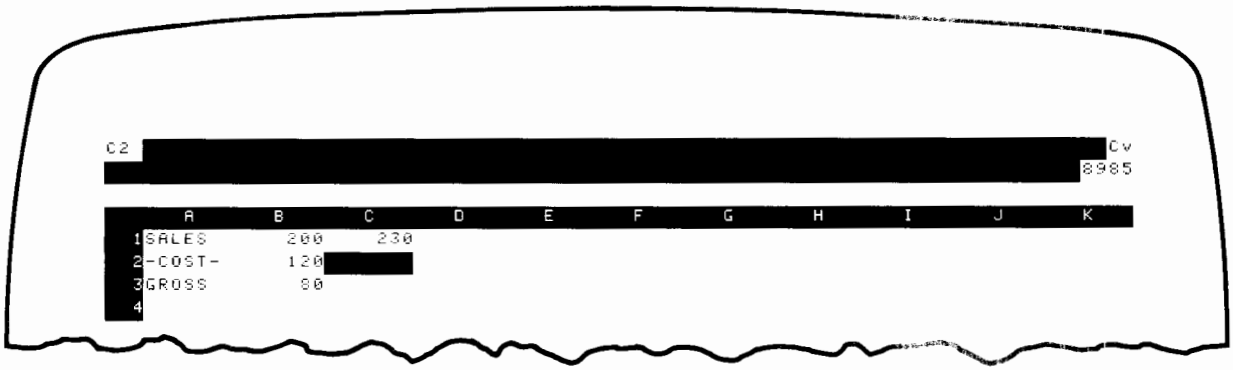
When you terminate an entry, command, or mode, you indicate to VisiCalc that you are finished and are ready to move on or begin a new entry. You have already seen how a label or value entry is terminated by using either [END LINE] or one of the cursor control keys, [↖], [↑], [↓], [→], or [←]. Terminating with [END LINE] leaves the cursor at the same cell; terminating with a cursor control key moves the cursor in the direction selected by the key, and it also sets the cursor direction indicator, located in the upper right-hand corner of the status area.

The [CONT] (*continue*) key can also be used to terminate a label or value entry. [CONT] terminates the entry and moves the cursor in the direction shown by the cursor direction indicator.

Let's try it by completing a column of calculations under C. First, move to cell C1 and enter a value representing sales of $230. Then move down to cell C2 with [↓]:

Press [SHIFT] [>] C1 [END LINE] 230 [↓]

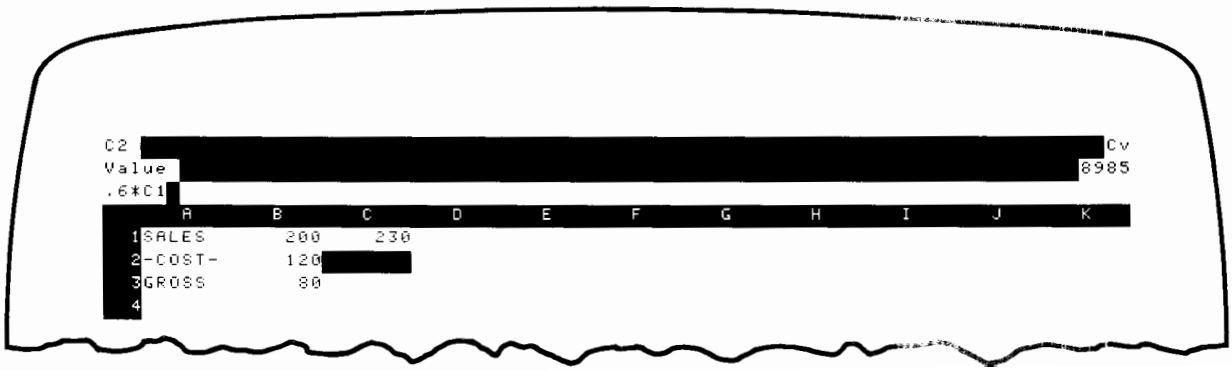
VisiCalc Display



Notice that the cursor direction indicator is pointing down. We want the formula at C2 to be .6 * C1:

Press .6 * C1

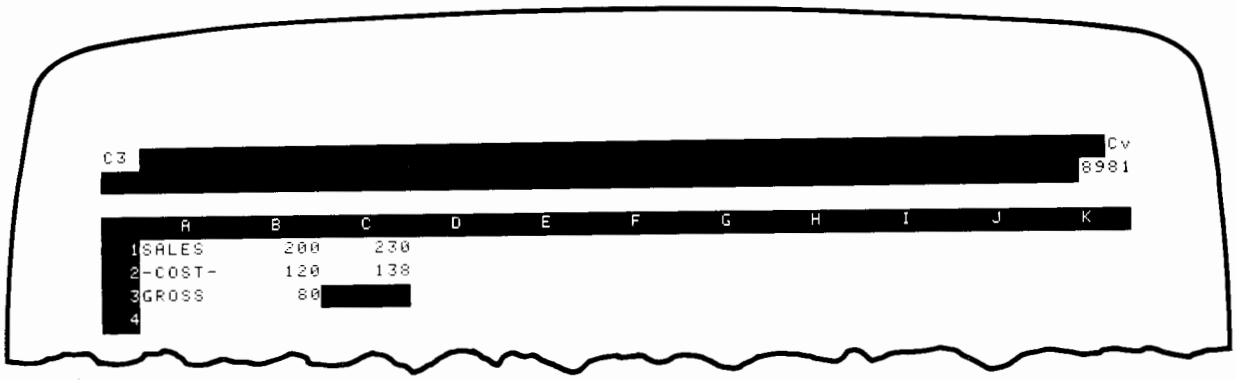
VisiCalc Display



Now we need to move to cell C3 and enter the formula for that cell. Since the cursor direction indicator is still pointing in the direction we want to move, we can simply *continue* with (CONT):

Press (CONT)

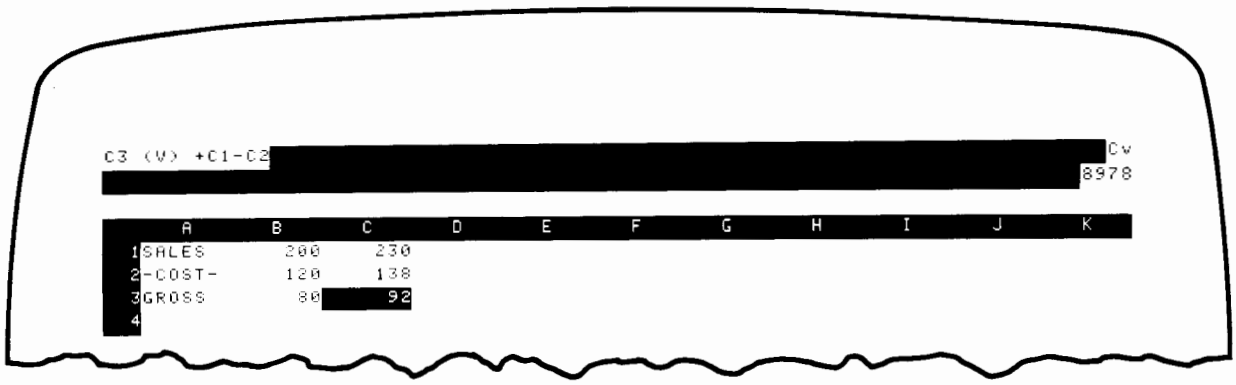
VisiCalc Display



(CONT) terminated the entry at C2 and continued on to cell C3. To finish our example, we can type in the formula for *gross*, + C1 − C2:

Press +C1 − C2 (END LINE)

VisiCalc Display



Any termination shifts VisiCalc back to top-level mode, where it is ready for a new entry or command.

VisiCalc Commands

VisiCalc has 16 commands to help you control input, worksheet and number format, worksheet calculations, and printed or stored output.

To select a VisiCalc command, you first type in the slash character, /. The prompt line then shows Command: BCDEFGIMPRSTVW-?, which is a list of the first characters of the commands. To select a command, you press the letter of the desired command. The letters may be upper- or lower-case.

Some commands have their own sets of additional subcommands to enable you to control or to select their options.

The operation of each command is covered in detail later in this manual. Here is the VisiCalc command set:

/B *Blank.* Resets a cell entry to a blank.

/C *Clear.* Clears the worksheet.

/D *Delete.* Deletes the row or column on which cell cursor lies.

/E *Edit.* Allows editing of the current cell's contents.

/F *Format.* Sets display format of cell entry.

/G *Global.* Sets special global status for column width, page size, background color, and cell format; sets automatic or manual recalculation, and sets recalculation order to row or column.

/I *Insert.* Inserts a blank row or column.

/M *Move.* Moves a row or column.

/P *Print.* Used to print the worksheet on an external printer or to a data file.

/R *Replicate.* Allows you to repeat an entry across a row or column, or to repeat an entire row or column.

/S *Storage.* Stores and loads the VisiCalc worksheet using a disc drive.

/T *Titles.* Allows you to fix window title areas.

/V *Version.* Displays VisiCalc's version number.

/W *Window.* Allows CRT screen to be split into two windows.

/— *Repeating Labels.* Allows repeating labels to be easily entered.

/? *Display Commands.* Displays the full name of each command.

The Question Mark Command, /?

The question mark command, /?, cycles the full names of the VisiCalc command set through the prompt line, displaying each command for about a second before continuing. After all commands have been displayed, VisiCalc remains in *command* mode, so you don't have to press [/] before selecting a command.

Terminating Command Mode

After executing any command except /?, VisiCalc returns automatically to top-level mode, ready for data entry or for you to select another command by pressing the [/] key. If you have pressed [/] and are in command mode, you can leave command mode *without* executing a command by simply pressing [END LINE] or any key (such as H or 2) not in the command set.

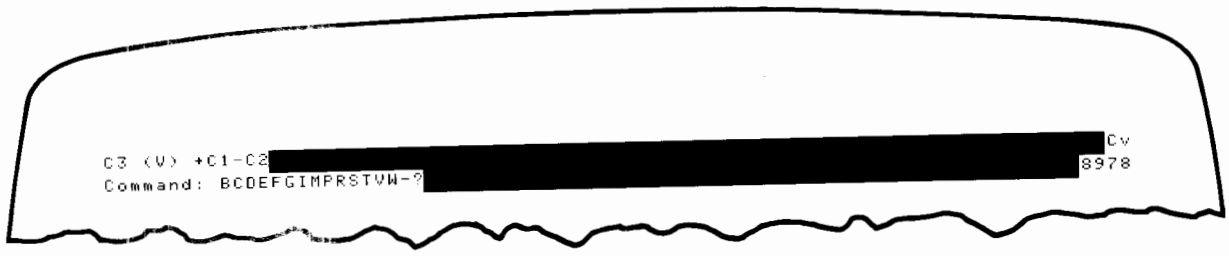
In most cases, at the subcommand level, pressing (END LINE) or any key not in the subcommand set returns VisiCalc to top-level mode without executing the command.

Version

An example of a simple command is Version. When you first load VisiCalc, the prompt line shows the *version number* of the VisiCalc program you're using. If you've been working the examples in this manual, the version number is no longer present in the display—but you can see it again by executing the /V command:

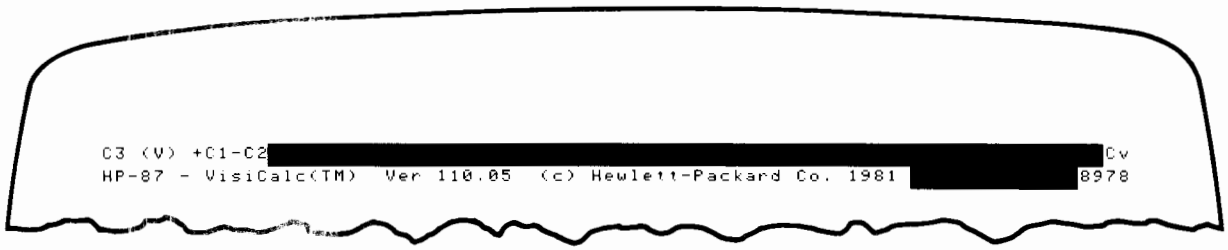
Press /

VisiCalc Status Area



Press V

VisiCalc Status Area



When you press the slash key, (/), the prompt line gives you the list of commands. When you then select Version, the version number is displayed.

If you ever need to communicate with Hewlett-Packard regarding your VisiCalc program, be sure to include your version number in your correspondence.

Repeating Labels

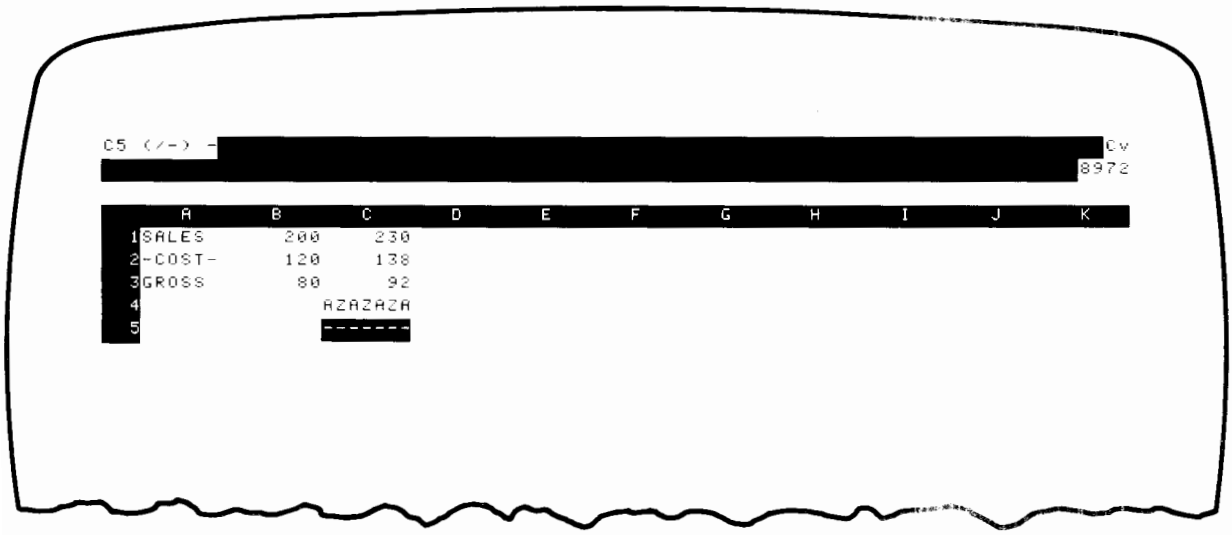
You can cause a character or group of characters to be repeated to form a label within a cell by using the repeating label command, /—.

When you type /—, the prompt line displays `Label: Repeating`. Any entry you then type is treated as a label, and fills the entire cell with repetitions of the label you typed in, regardless of the width of the cell. As with other entries, repeating label entry is terminated with (END LINE), (CONT), or one of the cursor control keys.

For example, typing /—ABC followed by (END LINE) fills the cell with ABCABCABC, etc. Following /—with a dash, —, fills the cell with dashes.

Press (>) C4 (END LINE) /—AZ (↓)
/—— (END LINE)

VisiCalc Display



Moving Right Along ...

You have now learned enough of the basics of VisiCalc to begin setting up solutions to your own calculating and forecasting problems. You will find that VisiCalc has been created with you, the user, in mind, and that you seldom have to consider such cryptic matters as VisiCalc *modes* or memory *bytes*. You simply move the cell cursor where you want it and type away.

There is still a great deal more to VisiCalc than you've learned so far. In the following pages you will learn how to store your work on a disc and how to print out the entire VisiCalc worksheet. You will also see how to arrange the worksheet exactly the way you want it, and you will learn a number of commands and techniques to save you time and worksheet space.

Of course, you can simply use the index and the table of contents when you need to learn something new. But we urge you to continue working through this manual, step-by-step, until you've seen all the functions and commands of VisiCalc. Your computations will be faster and easier.

Section 2

Storing Your Work

This section explains how to use the /S (*storage*) command to save your VisiCalc worksheet in a data file on a disc, then load the worksheet again into the computer. It also explains how to use VZREAD to read /PD and /SS files, and how to use VZWRITE to create /SS files.

Storage Commands

In VisiCalc, when you call up the storage command by pressing /S, the prompt line displays

```
Storage:
Load Store Delete Initialize Mass Storage Is
```

This prompts you to press an additional letter key to select a storage option. The L, S, and D options require that the user provide a file name. Whenever you enter a file name, you can append it with a mass storage unit specifier (msus) to direct VisiCalc to a disc drive other than the default disc drive. These are the storage commands:

/SL *Load.* The prompt line displays `File to load`. Loads data in worksheet form from a data file located on the disc. Does not clear the existing worksheet from computer memory before the new one is loaded.

/SS *Store.* The prompt line displays `File to store`. Stores data in the worksheet form into a data file on the disc.

/SD *Delete.* The prompt line displays `File to delete`. Deletes (purges) the specified file from the disc. After (END LINE) is pressed, the prompt line displays `Delete: Y to confirm`. Press Y to execute the command.

/SI *Initialize.* The prompt line displays `Initialize: Y to confirm`. Press Y to initialize the disc. The entire contents of the disc are erased.

/SM *Mass storage specifier.* The prompt line displays `Mass storage is`. Allows you to change the mass storage unit specifier. (For example, the mass storage unit specifier for a typical disc is :D700.) Follow the entry with (END LINE). If you enter (END LINE) without first entering a specifier, VisiCalc assumes the default mass storage unit and prints a directory for that mass storage unit.

Now let's look at these commands more closely.

Specifying the Storage Unit

As you use VisiCalc, you'll want to save your worksheets so you can turn the computer off at night or use it for some other task. You can save your worksheets on a floppy disc.

When the VisiCalc program is first loaded into the computer, VisiCalc assumes that the storage unit for the /S command is the default storage unit. You can also select another storage unit by using the /SM command. To change the specifier for the mass storage unit:

1. Type /SM. The prompt line displays `Mass storage is` to prompt you for the new mass storage unit specifier.
2. Type the mass storage unit specifier. Refer to the Series 80 computer manual for its specifier.
3. Press (END LINE) to execute the command. If you press (END LINE) without first typing in a mass storage unit specifier, VisiCalc assumes you want the previously selected storage unit, and it automatically prints a directory of all files on that mass storage unit. If no printer is connected to your personal computer, the directory will be displayed on the CRT screen. To get back to VisiCalc just press (SHIFT) (BACK SPACE) (INIT).

Storing the Worksheet

The VisiCalc worksheet, containing titles, data, formulas, etc., is stored on the disc as a data file. Before storing a file, you should first determine if you need to specify the mass storage unit, as outlined above.

Initialization

Initialization of a disc is only necessary if it hasn't been used before, or if you want to erase all the information previously recorded on it. You can add VisiCalc files to a disc already containing other VisiCalc files or even to a disc that contains program or data files.

> **CAUTION**
>
> Initialization of a disc erases all information previously recorded there.

To initialize a disc:

1. Be sure that the disc drive is properly connected to the computer and the disc is properly installed. Refer to the disc drive user's manual for details of its installation.
2. Press /S. The prompt line will display `Storage: Load Store Delete Initialize Mass Storage Is.`
3. Press I for *initialize*. The prompt line displays `Initialize : Y to confirm.`
4. Press Y. All contents of the disc are erased.

Storing on a Disc

When you press /SS, the *store* command, the VisiCalc worksheet is stored in a data file on the disc. A file is created automatically by the storage command; if a file with the selected name already exists, VisiCalc

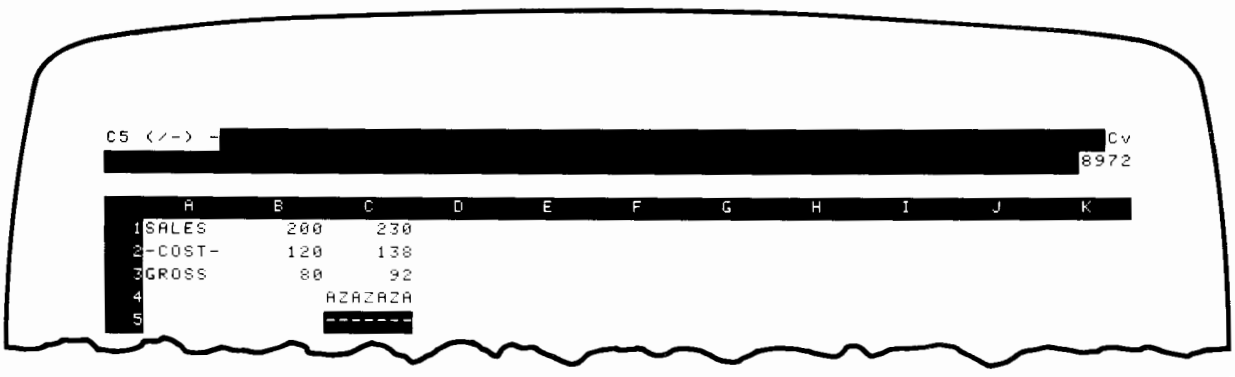
purges the old file and creates a new one with the same name. To store the worksheet with all its data on a disc:

1. Press /S to select the storage command. The prompt line displays `Storage: Load Store Delete Initialize Mass Storage Is`
2. Press S again to tell VisiCalc you want to store information. The prompt line asks you for the name of a `File to store.`
3. If you want a printed directory of the files contained on the disc, press (END LINE) without entering a file name. If no printer is connected to your personal computer (or you have designated the CRT as the printer), the directory will be displayed on the CRT screen. To get back to VisiCalc just press (SHIFT) (BACK SPACE) (INIT). You must then reenter the storage command.
4. Type in a file name. A file name can be up to ten characters long. If you make a mistake while keying in a file name, you can correct the mistake with (BACK SPACE).
5. When the file name has been entered, press (END LINE). The VisiCalc worksheet, with all data, titles, etc., is stored on the disc.

Refer to the computer owner's manual for file name conventions.

Example. If the worksheet remains intact from the example you worked in section 1, you can store that example. If not, ensure that the VisiCalc program has been loaded into the computer and your worksheet looks like the one shown:

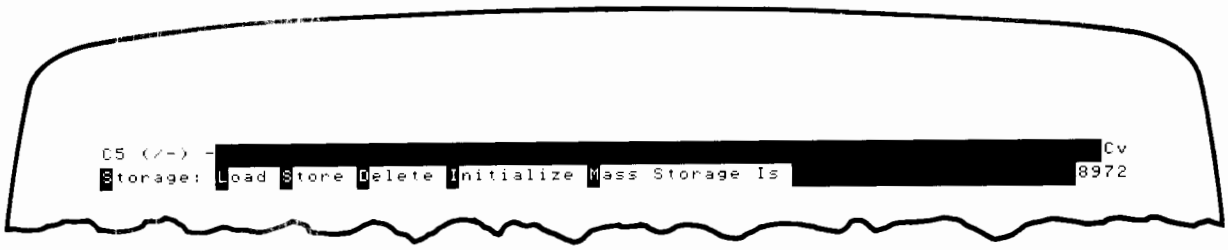
VisiCalc Worksheet



Now let's store this worksheet in a file named EX1. First, make sure that you've specified the desired mass storage unit (disc drive), and that the storage unit is connected to the computer. Then:

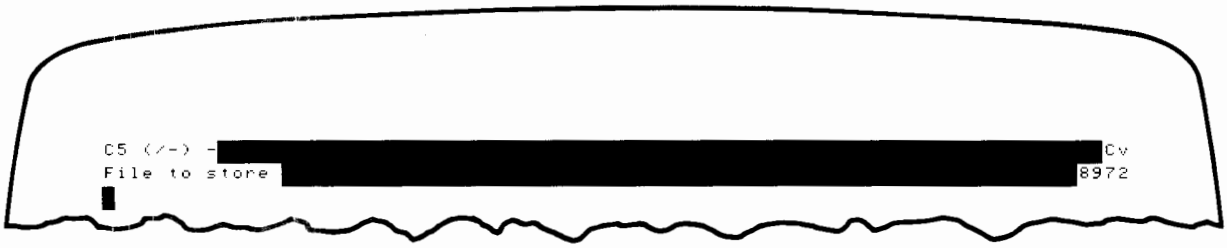
Press /S

VisiCalc Status Area



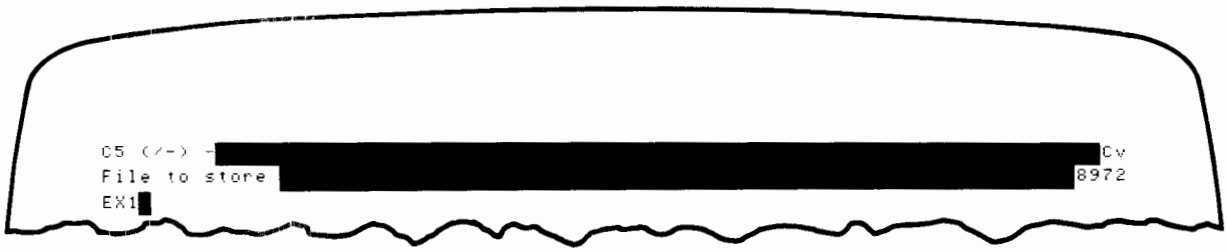
Press S

VisiCalc Status Area



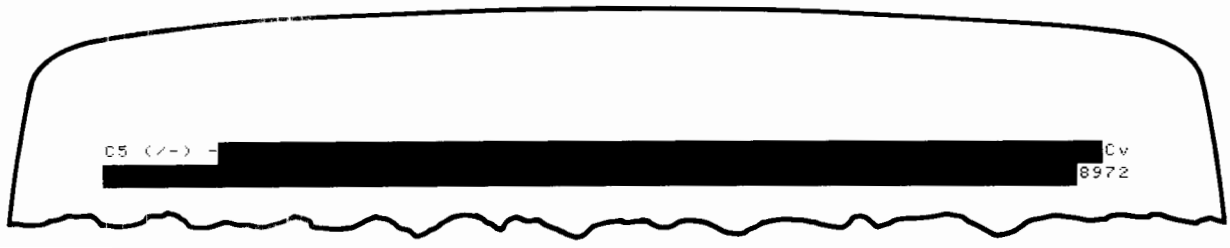
Press EX1

VisiCalc Status Area



Press END LINE

VisiCalc Status Area

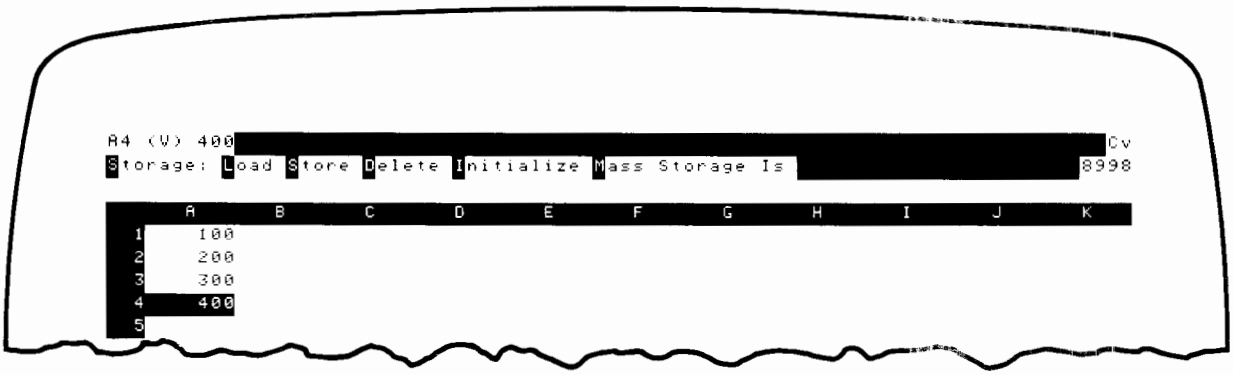


When you press (END LINE), the file EX1 is created on the disc and the worksheet is saved in the file. Notice that the location of the cell cursor did not affect the storage command.

To create a second file, you can repeat the process using different data and a different file name:

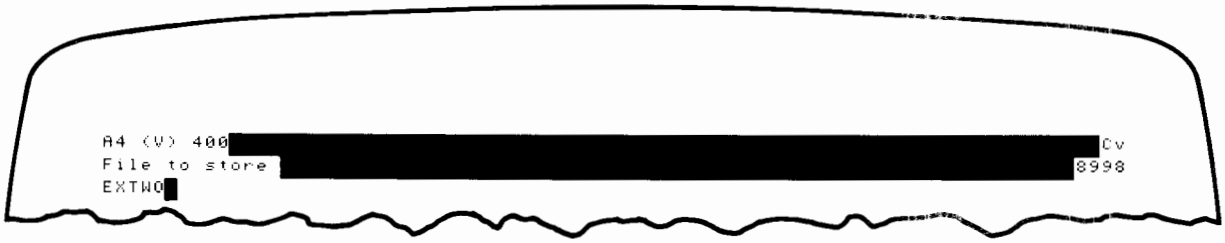
Press /CY 100 (↓) 200 (CONT) 300 (CONT) 400 (END LINE) /S

VisiCalc Display



Press S EXTWO

VisiCalc Status Area



Press (END LINE)

> **CAUTION**
>
> The /SS command purges the old file name, if one existed, and then creates a new one. If an /SS command results in a disc error, for example FULL, then another storage medium with enough space on it should be used to save the worksheet. If this error is produced, the old file is purged and cannot be restored.

Loading the Worksheet From a File

Loading a file from a disc is similar to storing that file. If you have forgotten the names of the files on the disc, when you are prompted for the File to load you can press (END LINE) to print the names of the files contained on the disc. Then type in the file name and continue.

To load a worksheet and data from a disc file into VisiCalc:

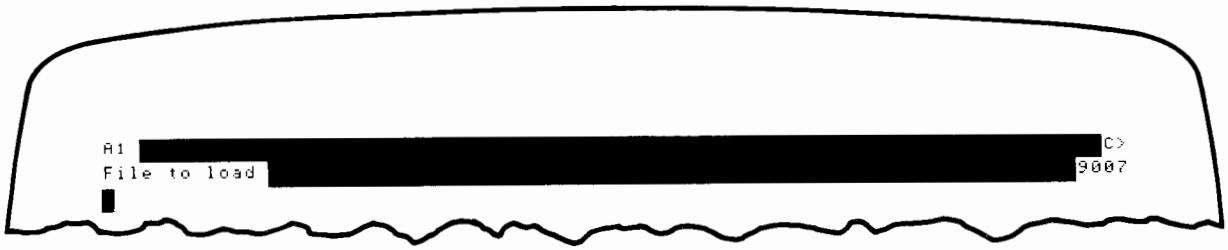
1. Press /S, followed by L, to select the storage command and the load option. The prompt line on the VisiCalc screen will ask for a `File to load`.
2. Enter the name of the desired data file onto the edit line. For a printed list of the disc files at this point, you can press (END LINE) first. If no external printer is attached to your Series 80 Personal Computer, the catalog will be displayed on the CRT screen. When you are finished viewing the catalog press (SHIFT) (BACK SPACE) (INIT) to return VisiCalc to top-level mode. Reenter the storage command. Then type in the desired file name.
3. Press (END LINE). The VisiCalc worksheet from the specified file is copied into computer memory.

Information from the file is copied onto the VisiCalc worksheet; it does not first erase existing data. So if you are careful about cell positions, you can copy data from a file into VisiCalc without disturbing information that is already present. This can be a very useful feature. For example, a VisiCalc data file consisting of a "blank form" with column and row labels entered could be constructed once, stored, and then reloaded and filled with data. This avoids the time consuming process of setting up the form labels every time the worksheet is to be used. You can then enter the data onto the prepared worksheet, or you can load a data file onto it if none of the data cell coordinates conflict with the labels on the prepared worksheet. As you're learning about VisiCalc, though, you'll probably want to clear the worksheet each time before loading a new file from the disc.

Example. Let's reload the data from the first example, EX1, onto the VisiCalc worksheet:

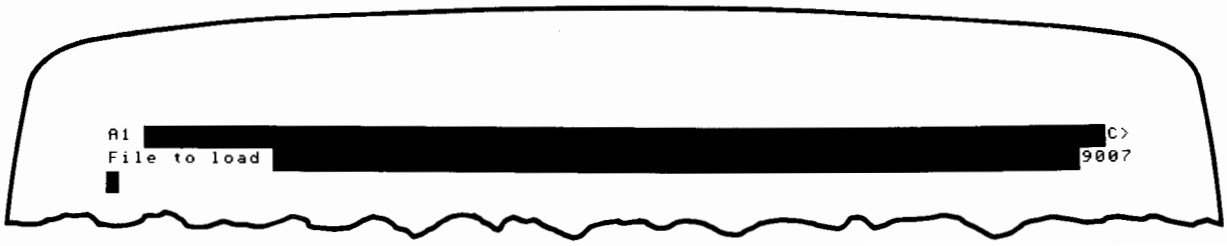
Press /CY /SL

VisiCalc Status Area



Press (END LINE)

VisiCalc Status Area



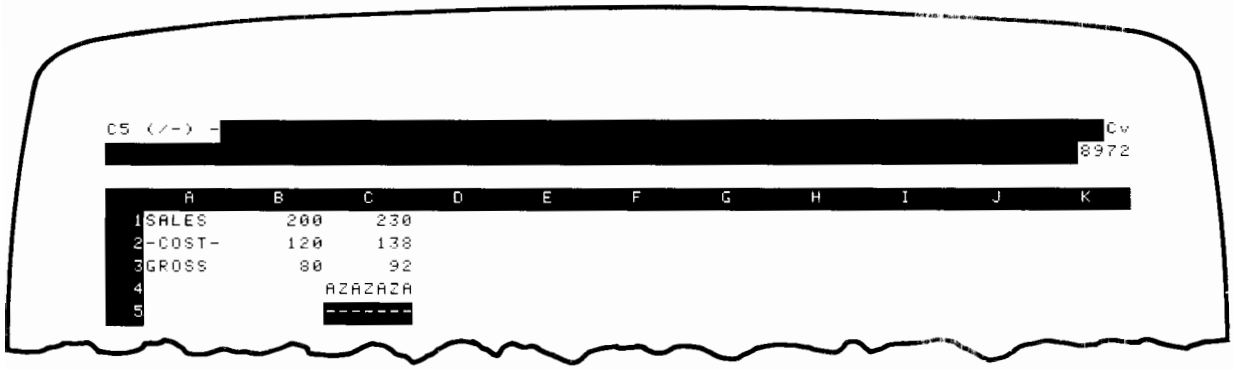
As you can see, a directory of the files on the disc has been printed, and the prompt line continues to ask for the name of a `File to load`. If there are no other files on a disc, for example, the directory of its files might look like this:

```
NAME      TYPE  BYTES   RECS FILE
EX1       DATA    256      1    1
EX TWO    DATA    256      1    2
```

Now we'll finish loading by typing in the name of the file EX1:

Press EX1 (END LINE)

VisiCalc Display



Notice that the cell cursor has returned to the position it occupied when the file EX1 was originally stored on disc.

If you had not cleared the worksheet before loading EX1, the data in those cells, such as A4, for which there was no new data from the file EX1 would have remained intact.

Deleting a File

The /SD command is used to delete a VisiCalc file (or any data file) from a disc. As when loading a file, you enter the name of the file onto the edit line from the keyboard. And, just as when loading a file, you can press (END LINE) to print out a list of the files on the disc before you type in the file name.

To delete a file from a disc:

1. Press /S followed by D. The prompt line displays `File to delete`.
2. Type in the name of the file to be deleted. (Or press (END LINE) to print a list of the files on the disc, then type in the file name.)
3. Press (END LINE). The prompt line then shows `Delete: Y to confirm`.
4. Press Y to execute the delete command. Any entry other than Y cancels the delete command.

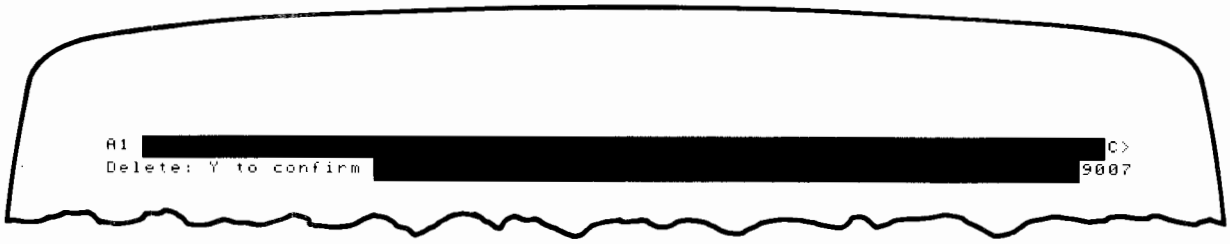
For example, to delete the file EXTWO from the disc:

Press /CY /SD

VisiCalc Status Area

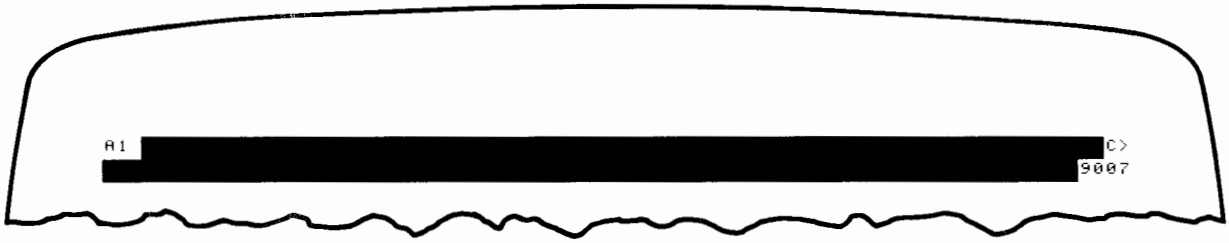
Press EXTWO (END LINE)

VisiCalc Status Area



Press Y

VisiCalc Status Area



Reading /PD and /SS Data Files

It is often useful to be able to read the data files which you previously created with VisiCalc, to identify the data on the files. Your VisiCalc PLUS disc contains a BASIC language program called VZREAD which you may use to read /PD or /SS data files.

To load the program, insert the VisiCalc PLUS disc into the disc drive and type LOAD "VZREAD" (END LINE). When the program is loaded, press (RUN). (If VisiCalc is still running, you must first end it by pressing (RESET) and then confirming the command by pressing Y.)

VZREAD will first ask you to define the printer. If you have no printer press 1 (END LINE). If you have a printer enter its address and follow it with (END LINE).

VZREAD will prompt `Enter file name: -OR- Press [END LINE] for catalog`. You now have the option of pressing (END LINE) to have the printer produce a catalog of the files available on the disc. Then you must enter the name of the file to be read and press (END LINE).

Next, VZREAD will prompt `Serial or Random access: (S/R)? Random access not used on /SS files` to ask for the reading method. If the file to be read is an /SS file, you must respond with S; the data will be accessed beginning with the first record on the file. The file is then printed and reading stops.

If, however, your file is a /PD file, then you can respond with either S or R. If you choose random access (R), VZREAD will repeatedly prompt `Enter record #: -OR- Press [END LINE] to end`. Following these prompts you may enter either a number followed by (END LINE) to see that record number, or an (END LINE) to stop reading. If you choose serial access (S), the file will be printed and reading will be stopped.

> Note: Because each record in a /PD file contains only one string, you may access data in this type of file at random. In contrast, the /SS file contains many strings per record and using random access will read only the first string in each record.

The /PD File

Data is stored in a /PD file in the form of character strings. Each file record contains one string, which corresponds to one VisiCalc worksheet cell. If the cell contained a label, the string will consist of that label. If the cell contained a value or expression, the string will consist of the value or the result of evaluating the expression, rather than the actual expression. The length of each string is equal to the worksheet column width, with blanks used as fill characters.

Recall that the number of strings in your /PD file is controlled by the cell cursor when the /PD command is issued, and by the lower right cell which you specified.

If the example worksheet is section 1 had been stored as a /PD file called TESTPD, from cell A1 to cell C3, and then read with VZREAD the results would be:

Serial Access

```
File name: TESTPD

SALES
     200
     230
-COST-
     120
     138
GROSS
      80
      92
```

Random Access

```
File name: TESTPD

RECORD NUMBER:  1   SALES
RECORD NUMBER:  4   -COST-
RECORD NUMBER:  7   GROSS
RECORD NUMBER:  2        200
RECORD NUMBER:  5        120
RECORD NUMBER:  8         80
RECORD NUMBER:  3        230
RECORD NUMBER:  6        138
RECORD NUMBER:  9         92
```

The /SS File

The data and organizing structure for the *entire* VisiCalc worksheet are stored in an /SS file. An /SS file consists of 256-byte physical records. Each record contains a series of strings, one string for each VisiCalc cell. By examining the /SS file you can see the actual expressions which were used to compute the worksheet values.

If the example worksheet in section 1 had been stored as an /SS file called TESTSS, and then read with VZREAD the result would be:

```
File name: TESTSS
>C3:@C1-C2
>B3:@B1-B2
>A3:"GROSS
>C2:.6*C1
>B2:.6*B1
>A2:"-COST-
>C1:230
>B1:200
>A1:"SALES
/W1
/GOC
/GRA
/GC7
/X*/X>A1:>C3:
```

Each string includes either the > (GOTO coordinate) character or the / (command) character. The last character in each string is the end line or CHR$(13) which appears as a blank. Note that the organizing structure contains several commands, including: /W1, one window, and /GOC, the global command specifying the order of recalculation as column priority. The final command is an internal VisiCalc command and includes *, a direction indicator character, and >C3 the cell cursor location. Different worksheets will have different organizing commands depending on their structure.

Writing to an /SS File

Often, raw numeric data can be stored by another HP application pac (Math Pac, General Statistics Pac, etc.) in a data file consisting of a single dimension array. HP VisiCalc PLUS also includes a BASIC program called VZWRITE which enables you to create /SS files from such a file. This further extends the compatibility of VisiCalc PLUS with other Hewlett-Packard application pacs. An /SS file so created could then be loaded onto the VisiCalc worksheet.

VZWRITE will accept any file consisting of a single dimension array containing exclusively numeric data. Such a file must be contained on a flexible disc.

Array Size

If your Series 80 Personal Computer does not have a plug-in memory module, your data array cannot exceed 600 elements. With a 32K memory module VZWRITE can process an array as large as 1970 elements. If your plug-in memory is 64K or greater, the array in your data file can contain up to 2700 elements.

The Wrap-Around Sheet Load

VZWRITE will load the array either across the rows or down the columns, according to your needs. You provide both the beginning cell location and either the column limit or the row limit, depending on whether you are loading across the rows or down the columns.

For example, let's say we are loading an array of length 40 which is in file ARRAY40 into an /SS file. We might begin in cell C3 with loading proceeding across the rows (C3, D3, E3, etc.), and set a column limit of L. This means that the tenth element of ARRAY40 will go into cell L3 and the eleventh will go into cell C4. During loading the array's elements will continue to "wrap-around" to the beginning cell's column every time we fill a cell in column L. The wrap-around would go back to the beginning cell's row if we were loading down the columns. We could also decline to set a column limit, in which case the data would wrap-around when it hit the edge of the worksheet (column BK). If we were loading down the columns and declined to declare a row limit, the data would wrap-around when it hit the last worksheet row (row 254).

Running VZWRITE

To load VZWRITE first make sure the VisiCalc PLUS disc is properly installed in your disc drive. Then press LOAD "VZWRITE" (END LINE). If you have a single disc drive, you should check that the data required for each step is available in the disc drive when it is needed. If you have more than one disc drive then you can insert both the VisiCalc PLUS disc and the disc with the data array and avoid having to switch discs. You may want to keep the VisiCalc PLUS programs, your source data, and your new /SS file data all on separate discs. If your system has fewer than three disc drives, this will require that you switch at least one of the discs while the program is running. Press (RUN).

VZWRITE will prompt you to `Enter :MSUS or .VOLUME label of source disc` and later will repeat the prompt for the destination disc. How you answer these prompts will determine which disc VZWRITE will go to to retrieve your data and to write its output file. Whenever VZWRITE is preparing to do a disc operation, it will tell you what disc to install in which drive according to your :MSUS or .VOLUME declarations. The answers to these two prompts can be identical (in which case your /SS file will be written on the same disc as your data array).

Your answers are scanned for the proper length and beginning character (colon or period). You must correct your answers if they do not pass this scan. If your answers pass the scan but still do not address a disc, you will be asked later to correct them.

Next, VZWRITE asks for the name of the data array file and gives you an option to see the disc catalog. If you want to see the catalog, press (END LINE). If this is the first time a catalog has been requested, VZWRITE will first ask you where you want the catalog to be routed (the CRT or an external printer). All future catalogs will be routed to this device. After the catalog has been printed, you must enter the data array file name.

The next prompt is `Do you want the data from` (file name) `placed in an /SS file by row or column: (R/C)?`. If you respond with R, the array will be loaded across the rows (A1, B1, C1, etc.). A response of C causes a columnwise load (A1, A2, A3, etc.).

Then VZWRITE wants you to `Enter the starting cell location`. This will be the top- and left-most cell of your /SS file, and can be any legal cell on the worksheet (from A1 out to BK254). This is where the cursor will appear when the /SS file is loaded onto the VisiCalc worksheet.

Then you will be asked to define a bottom row limit or a right column limit, depending on your loading priority (row or column). If you are loading across the rows, enter the column where you want the wrap-around to begin (AF, BI, Y, etc.). If your data is to be loaded down the columns, enter the row where you want the wrap-around to begin (25, 111, 243, etc.). If you don't want to set a limit just press (END LINE), and the data array will wrap-around at column BK (or row 254).

VZWRITE will assemble the data in the proper file formation. If it is unable to complete this step (either because it has run out of cells in your defined worksheet size, or there are too many array elements for your internal memory), it will tell you how many elements have been assembled. It will also ask you if you want to save the partially assembled sheet.

If no limits have been reached and the size of your data array does not exceed your memory, VZWRITE will then ask for the name of your new /SS file (and give you the END LINE option for a catalog). Enter the name of the new /SS file.

If you have duplicated an existing data file name you will see `File name` (file name) `already exists. Select Option: (O/R/C).` You must do one of three things: press O END LINE to overwrite the old file with the new one, or press R END LINE to rename the new /SS file, or press C END LINE to cancel the store operation.

If you have not duplicated a file name, then VZWRITE will inform you of a successful store operation, and tell you the starting cell location and the ending cell location.

Editing the Worksheet

This section illustrates how to use the *clear* command, /C (or the [CLEAR] or [-LINE] keys), the *blank* command, /B, and the *edit* command, /E (or the [ROLL] key), to edit and alter your cell entries. It also illustrates how to use the *insert* command, /I, the *delete* command, /D, and the *move* command, /M, to alter the form of your worksheet.

Clearing the Worksheet

The /C (*clear*) command lets you clear all entries from the VisiCalc worksheet.

To clear the VisiCalc worksheet:

1. Press [/] to select the VisiCalc command set. The prompt line shows `Command: BCDEFGIMPRSTVW-?.`
2. Type the letter C. The prompt line shows `Clear: Y to confirm.`
3. Type Y (for *yes*). This clears the worksheet, resets all cell entries to blanks, resets formats, windows, titles, etc.

[CLEAR] and [-LINE] also perform the clear command, exactly as when you type /C.

If when the prompt line shows `Clear: Y to confirm` you type any entry other than Y, that entry is discarded and VisiCalc returns to its setting before you pressed [/].

CAUTION

The [RESET] key clears the worksheet, and it also resets the computer to BASIC mode. Be sure that you save your worksheet on disc, as detailed in section 2 of this manual, before pressing [RESET].

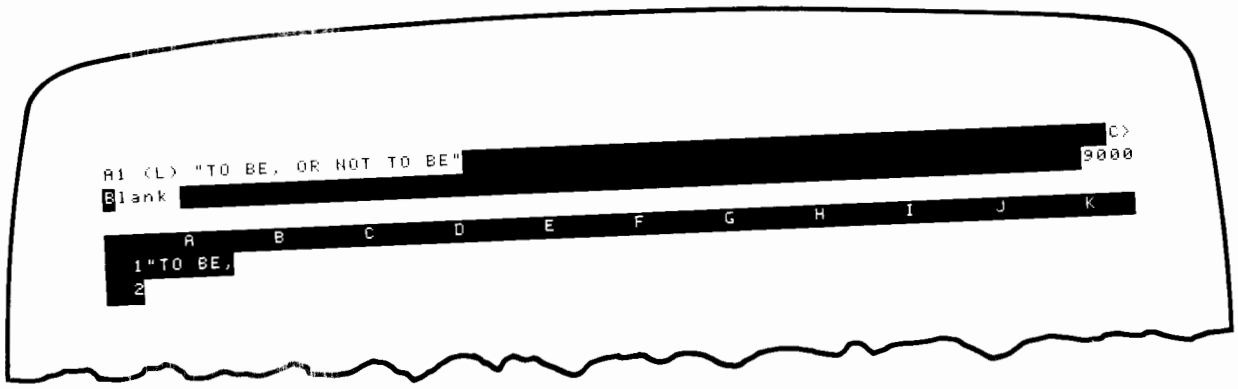
Replacing Cell Contents With Blanks

To replace the contents of any cell with a blank (what each cell contains when the worksheet is cleared), use the /B (*blank*) command. To change the contents of a cell to a blank, set the cell cursor to the cell and type /B, then press [END LINE].

Example. To clear cell A1 of a label:

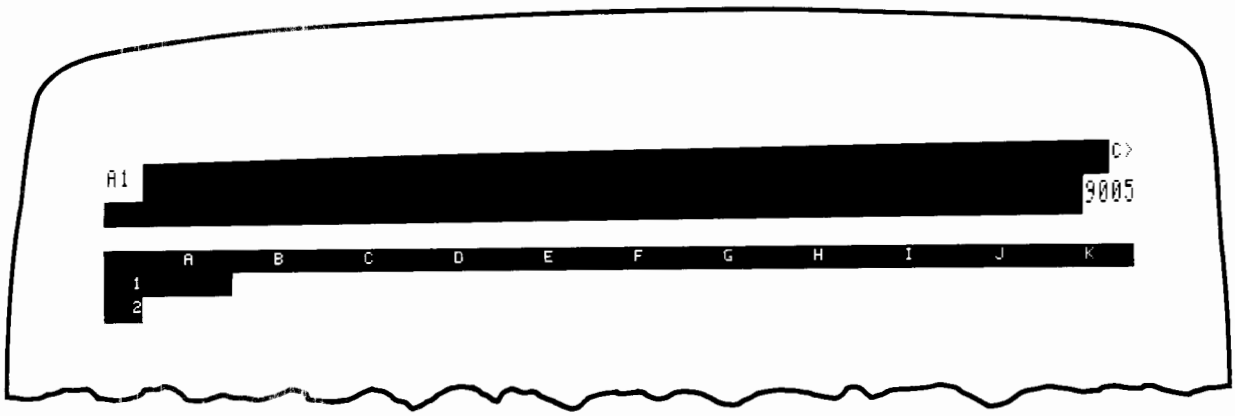
Press /CY ' "TO BE, OR NOT TO BE" [END LINE] /B

VisiCalc Display



Press END LINE

VisiCalc Display



Edit Mode

Up to this point, you've been able to edit cell entries of the VisiCalc worksheet only as you've written them in, by using the BACK SPACE key. However, additional editing capabilities of VisiCalc greatly increase your control over value and label entries.

When VisiCalc is in edit mode, you control the *edit line cursor,* instead of the cell cursor, with the cursor control keys ↖, ↑, ↓, →, and ←. Edit mode also displays the current cell contents on the edit line in addition to the entry contents line of the status area. Edit mode makes it easy for you to modify complicated expressions right in their cells without "rewriting" the entire cell contents.

Switching Into Edit Mode

Use the /E (*edit*) command to switch to edit mode and edit the previously entered contents of a cell. Use the ROLL key to switch to edit mode and edit a label or expression which you are currently entering into a cell.

When you switch to edit mode:

1. The prompt line displays EDIT to indicate that VisiCalc is in edit mode.

2. The edit line contains the contents of the current cell, which can be up to 158 characters long. (Only 79 characters of the expression can be displayed on the edit line at one time.) If the line is a long one, the first 79 characters of the line are "scrolled" through the edit line, then the last part of the line is displayed.

3. The cursor movement keys, [↖], [↑], [↓], [→], and [←] do not affect the cell cursor. Instead, they control the edit line cursor.

   [←] and [→] move the edit line cursor along the edit line, for setting that cursor to the exact character to be edited. The computer beeps if no further movement is possible.

   [↖] or [↑] cause the first portion of the edit line to be displayed. [↑] causes the computer to beep if no further movement is possible.

   [↓] causes the second portion (if present) of the edit line to be displayed. The computer beeps if no further movement is possible.

4. [I/R], [-CHAR] and [BACK SPACE] can be used to insert, replace, or delete characters from the edit line. [I/R] alternates between *insert* and *replace* modes. [-CHAR] deletes single characters.

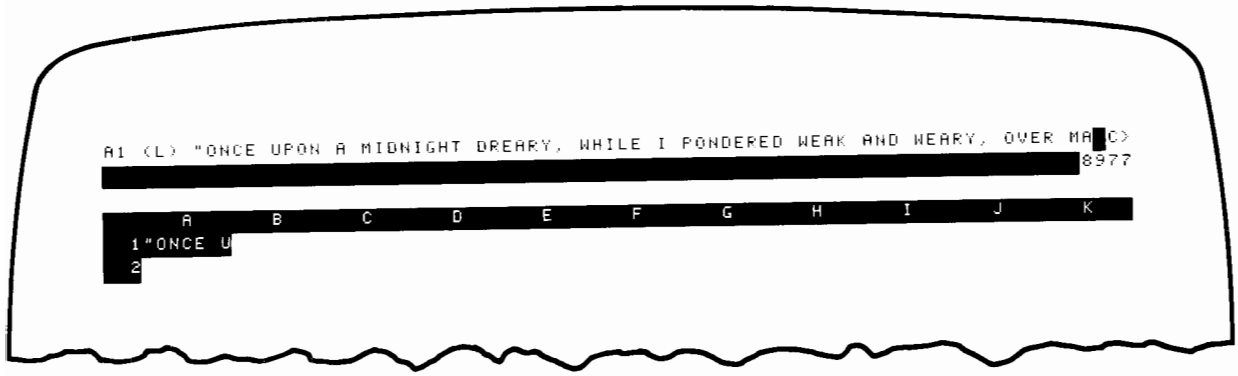
Switching Out of Edit Mode

VisiCalc automatically restores normal operation and switches out of edit mode when you terminate an entry by pressing [END LINE] or [CONT]. If you use [ROLL] or [SHIFT] [ROLL] to switch cursor control out of edit mode, the next cursor movement terminates the entry and moves the cell cursor.

Example. Let's type in as a label "ONCE UPON A MIDNIGHT DREARY, WHILE I PONDERED WEAK AND WEARY, OVER MANY QUAINT AND CURIOUS VOLUME OF FORGOTTEN LORE—" EDGAR ALLEN POE.

Press /CY ' "ONCE UPON A MIDNIGHT DREARY, WHILE I PONDERED WEAK AND WEARY, OVER MANY QUAINT AND CURIOUS VOLUME OF FORGOTTEN LORE—" EDGAR ALLEN POE. [END LINE]

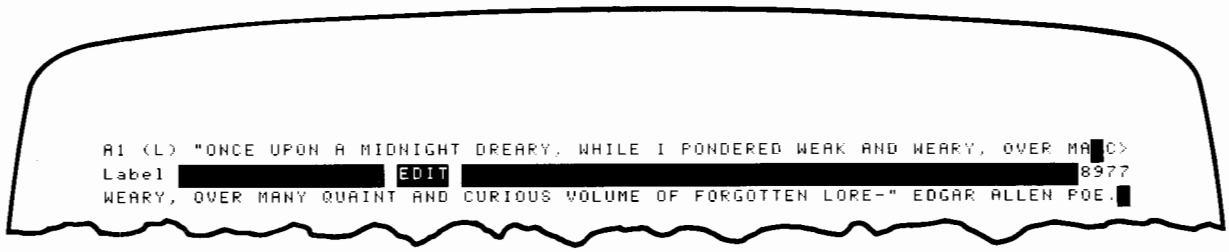
VisiCalc Display



Now that the label is entered into cell A1, let's use edit mode to correct this misquoted line:

Press /E

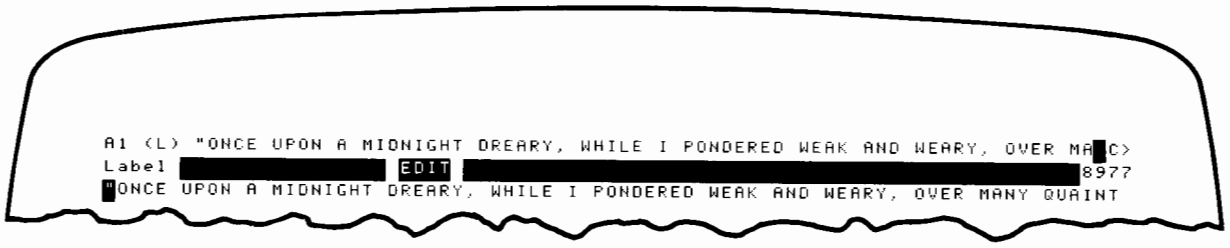
VisiCalc Status Area



Now the cursor control keys ← and → move the edit line cursor, while ↖, ↑ and ↓ can be used to view the first or second part of the line.

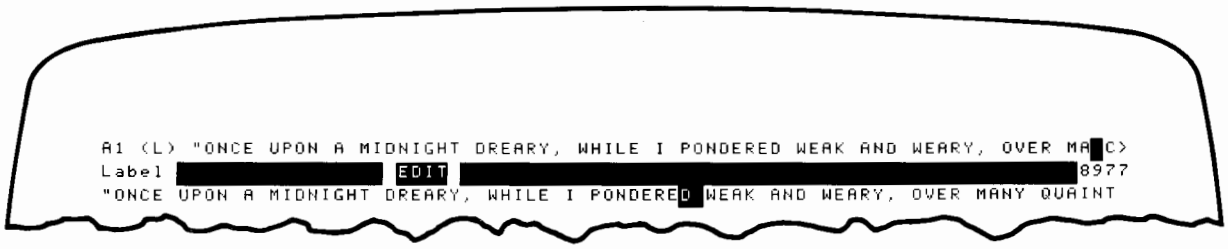
Press ↖

VisiCalc Status Area



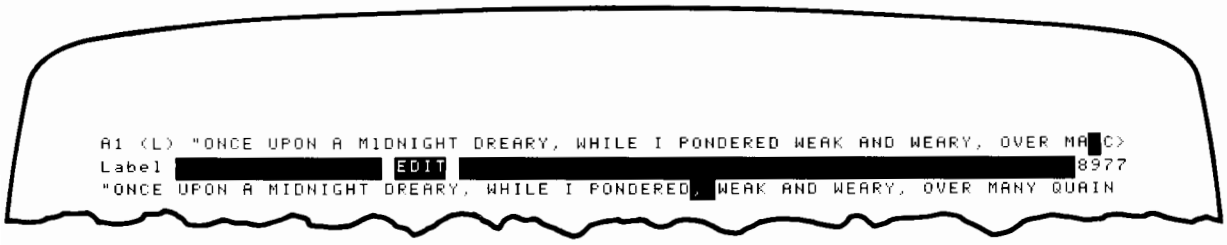
Press and Hold → I/R

VisiCalc Status Area



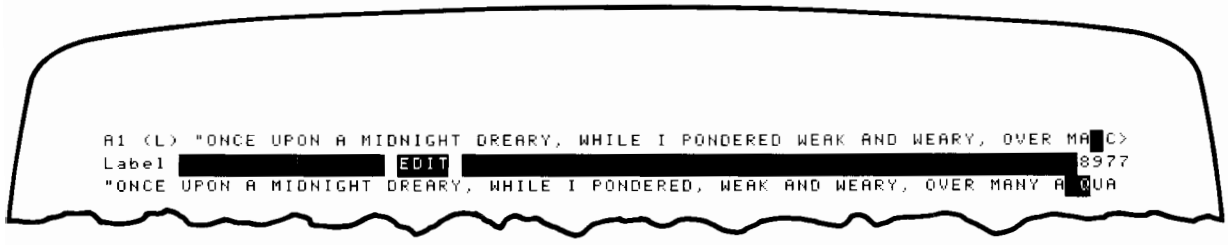
Press ,

VisiCalc Status Area



Press and Hold → A SPACE

VisiCalc Status Area

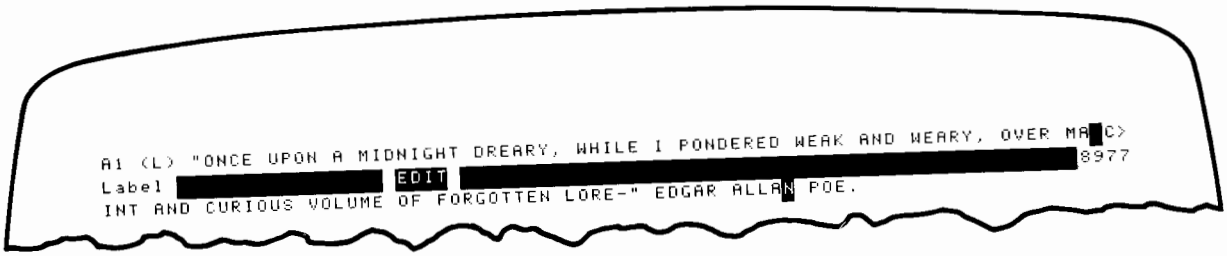


On the edit line we now have the quotation as Poe actually wrote it (in his poem, *The Raven*). Let's further edit the label by correcting Poe's middle name:

Press ↓

Press and Hold → I/R A

VisiCalc Status Area

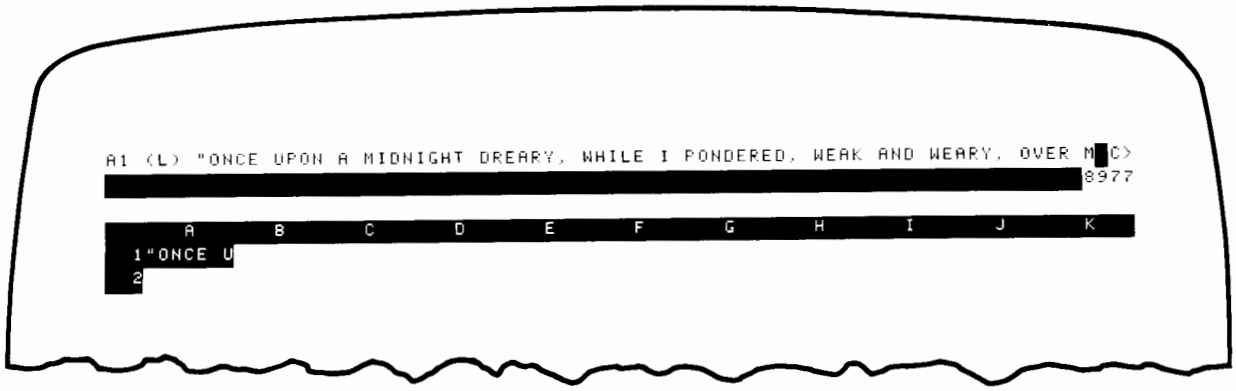


The ↓ key places the second part of the label on the edit line. (The I/R key switches between *replace* mode, where you'll see only a single cursor, and *insert* mode, where a double cursor is visible. For details of I/R operation, consult your computer owner's manual.)

Finally, now that the quotation is correct, we'll terminate the entry and leave edit mode:

Press END LINE

VisiCalc Display



Editing During Cell Entry

You can switch temporarily to edit mode as you are typing in the contents of a cell by pressing the ROLL key. When you press ROLL, VisiCalc switches to edit mode, and you can edit the expression you are entering. The word EDIT appears on the prompt line to verify that VisiCalc is in edit mode.

To switch out of edit mode again, just press ROLL once more. ROLL (or SHIFT ROLL) switches VisiCalc between data entry and edit mode, making it easy for you to change or correct your entries as you type them in.

As you use VisiCalc, you will find that edit mode permits you to modify expressions quickly, rather than completely rewriting them. Be sure to use edit mode as you work through this manual, and in setting up your own VisiCalc worksheet.

Inserting a Row or Column

The /I (*insert*) command in VisiCalc makes it easy for you to insert a row or column onto the worksheet. You simply set the cell cursor on the row which is to be just below the new row, or on the column which is to be just to the right of the new column.

When you press /I, the prompt line displays **I**nsert: **R**ow **C**olumn.

/IR Inserts a *row* just above the row to which the cell cursor is currently set.

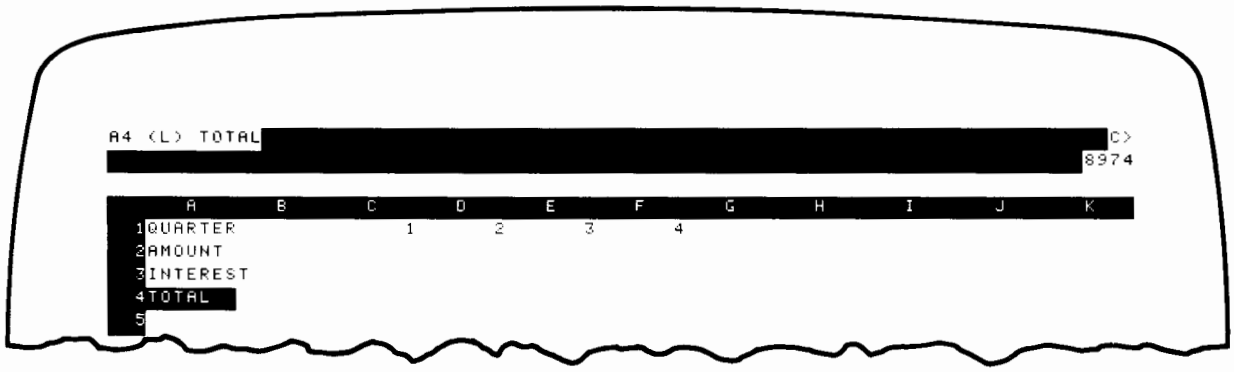
/IC Inserts a *column* just to the left of the column to which the cell cursor is currently set.

When you insert a row or column, subsequent rows or columns are moved, and any value references are automatically rewritten to reflect the new row/column status.

Example. Let's set up a simple schedule of interest payments. We will assume an initial investment of $4000 drawing 7.9% quarterly:

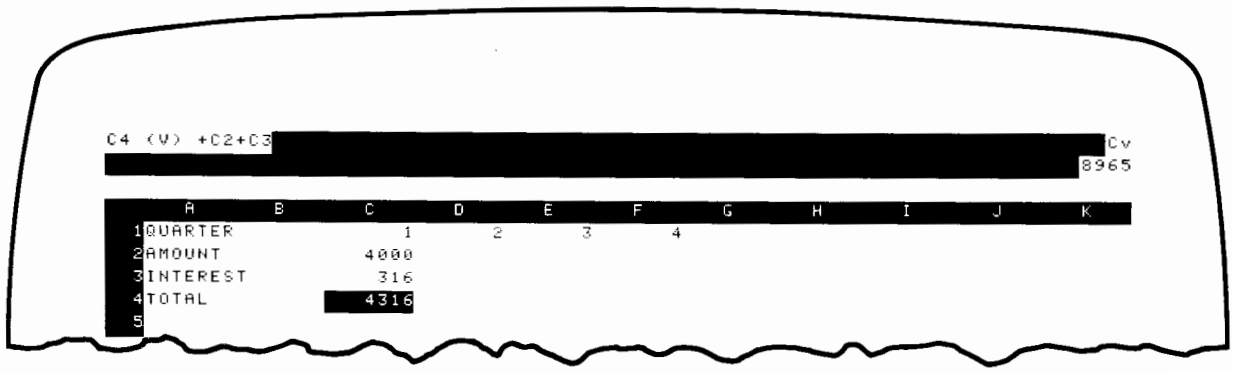
Press /CY QUARTER → → 1 → 1 + C1 → 1 + D1 → 1 + E1 END LINE > A2 END LINE
AMOUNT ↓ INTERES → T END LINE > A4 END LINE TOTAL END LINE

VisiCalc Display



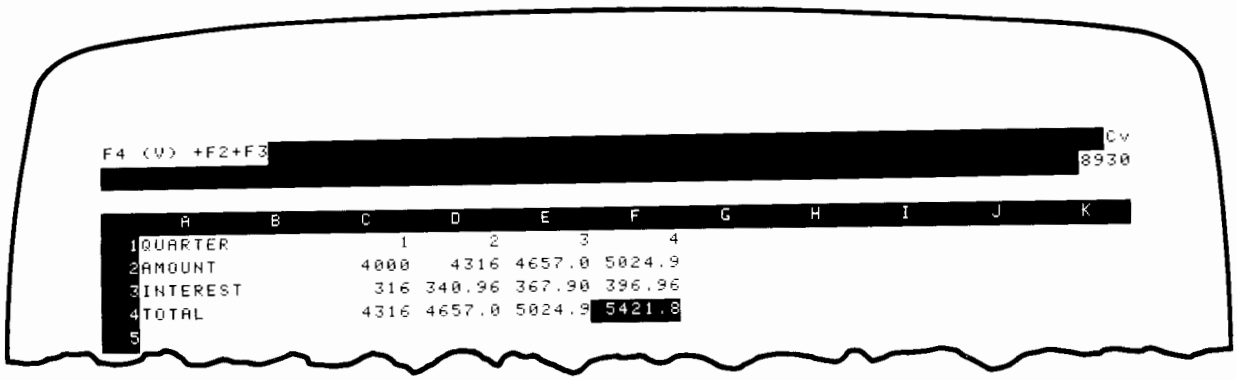
Press > C2 END LINE 4000 ↓ .079 * C2 ↓ + C2 + C3 END LINE

VisiCalc Display



Press (>) D2 (END LINE) + C4 (↓) .079 * D2 (↓) + D2 + D3 (END LINE) (>) E2 (END LINE) + D4 (↓) .079 * E2 (↓) + E2 + E3 (END LINE) (>) F2 (END LINE) + E4 (↓) .079 * F2 (↓) + F2 + F3 (END LINE)

VisiCalc Display

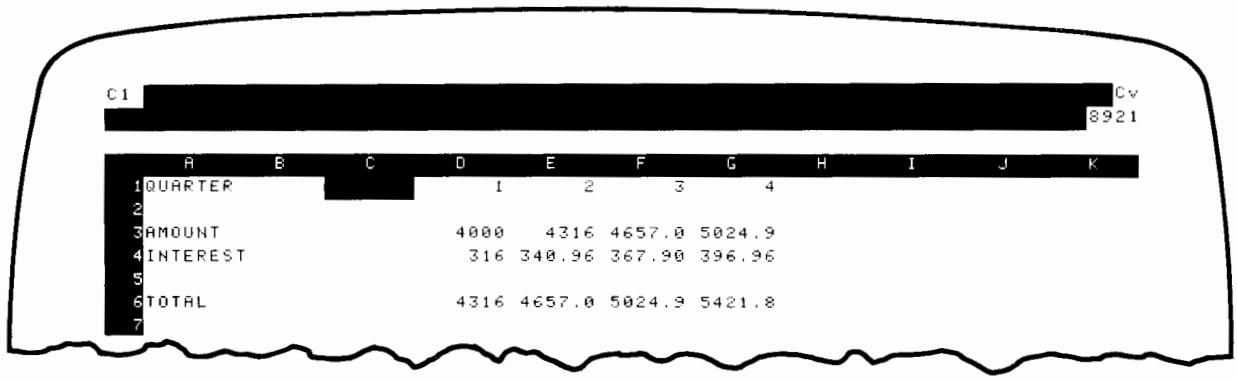


Notice that our entry beginning at cell A3, INTEREST, is too long to fit in one cell, so we entered it into two adjacent cells. Since VisiCalc justifies labels to the left in their cells, it appears as one word. This is a common method to obtain more complete titles on a worksheet without decreasing the number of cells displayed. Occasionally you will want to fit a long label into a single cell; for this you will need to expand the cell size. This is described in section 6, Formatting the Worksheet.

This worksheet is not as readable as it could be, so let's insert some rows and columns to separate the data. We'll insert rows below the *quarter* row and the *interest* row, and a column after the title column:

Press (>) B2 (END LINE) /IR (>) C5 (END LINE) /IR (>) C1 (END LINE) /IC

VisiCalc Display

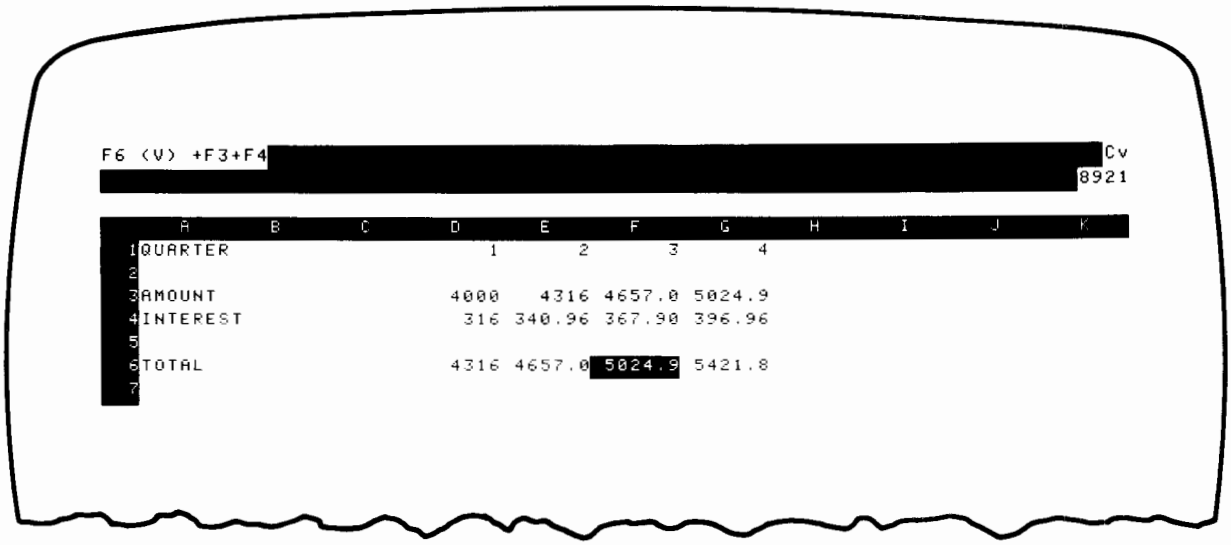


When inserting a row, it doesn't matter where in the row the cell cursor is, just as long as the cursor is somewhere in the row which is to follow the inserted row. The same is true for columns.

Now move the cell cursor to cell F6 and examine the formula:

Press (>) F6 (END LINE)

VisiCalc Display

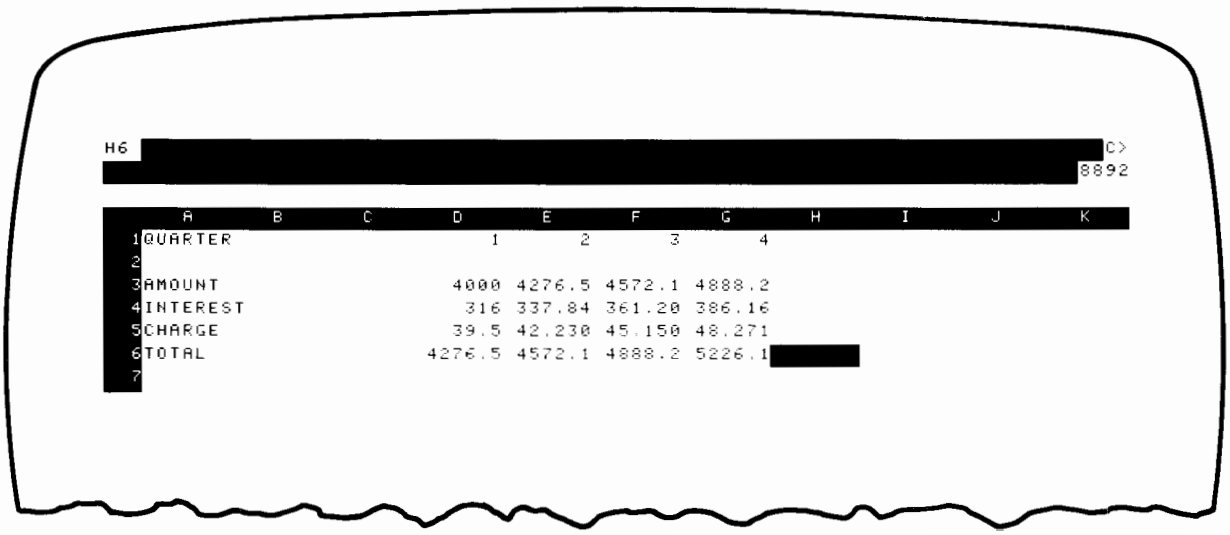


When you insert a row or column, VisiCalc automatically updates all value references to maintain the old relationships on the new worksheet.

If you want to use values or value references in the new row or column, you must change other formulas on the worksheet which depend on the new values. For example, suppose there is a service charge on our investment of 12.5% of the interest paid each quarter. We can subtract the service charge on row 5, but we must take this charge into account when computing our quarterly totals:

Press (>) A5 (END LINE) CHARGE (→) (→) (→) .125 * D4 (CONT) .125 * E4 (CONT) .125 * F4 (CONT) .125 * G4 (END LINE) (>) D6 (END LINE) /E − D5 (CONT) /E − E5 (CONT) /E − F5 (CONT) /E − G5 (CONT)

VisiCalc Display



Deleting a Row or Column

You can use the /D (*delete*) command to delete a row or column from the VisiCalc worksheet. To use the command, just set the cell cursor to any place along the row or column to be deleted, then type /D. The prompt line displays Delete: Row Column

/DR Deletes the *row* on which the cell cursor lies.

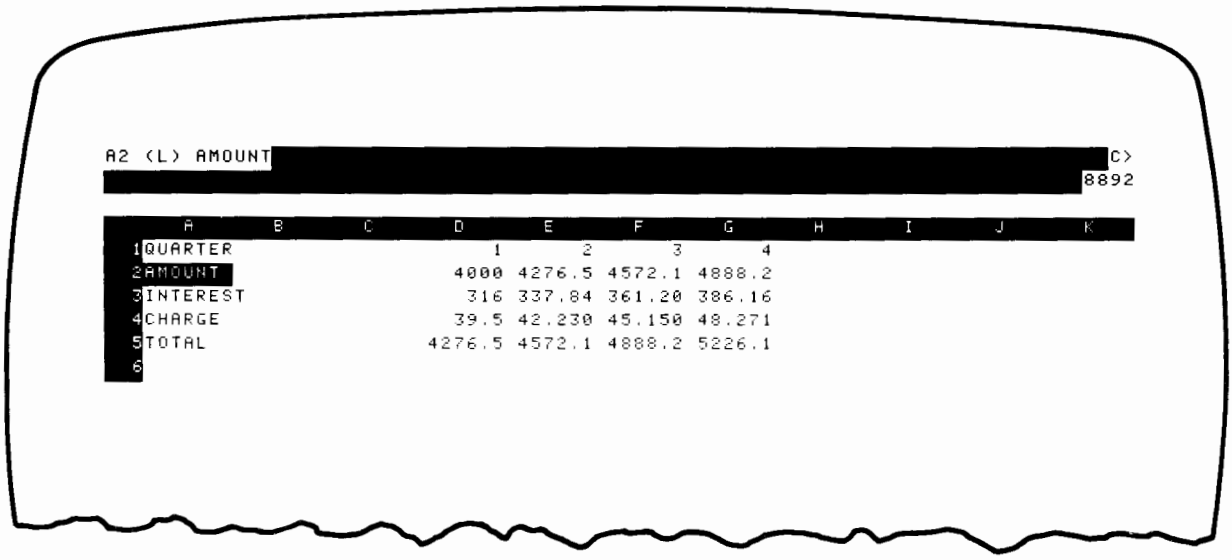
/DC Deletes the *column* to which the cell cursor is set.

All value references affected by the deleted column or row are automatically rewritten to reflect the new row/column status. Deleting a row or column which contains cells referenced by other cells will generate ERROR in the dependent cells and their formulas.

Example. In the annuity schedule, to delete the row of blanks that now occupies row 2:

Press (>) A2 (END LINE) /DR

VisiCalc Display



If you examine the formulas in the cells below row 2, you will find that they now reflect the new dependent status.

Note: Be careful in selecting the row or column option after you have specified the delete command. Once the row or column option has been entered, the information on that row or column can never be accessed.

Moving a Row or Column

The /M (*move*) command permits you to move any row or column on the VisiCalc worksheet to any other row or column location.

To move a row or column:

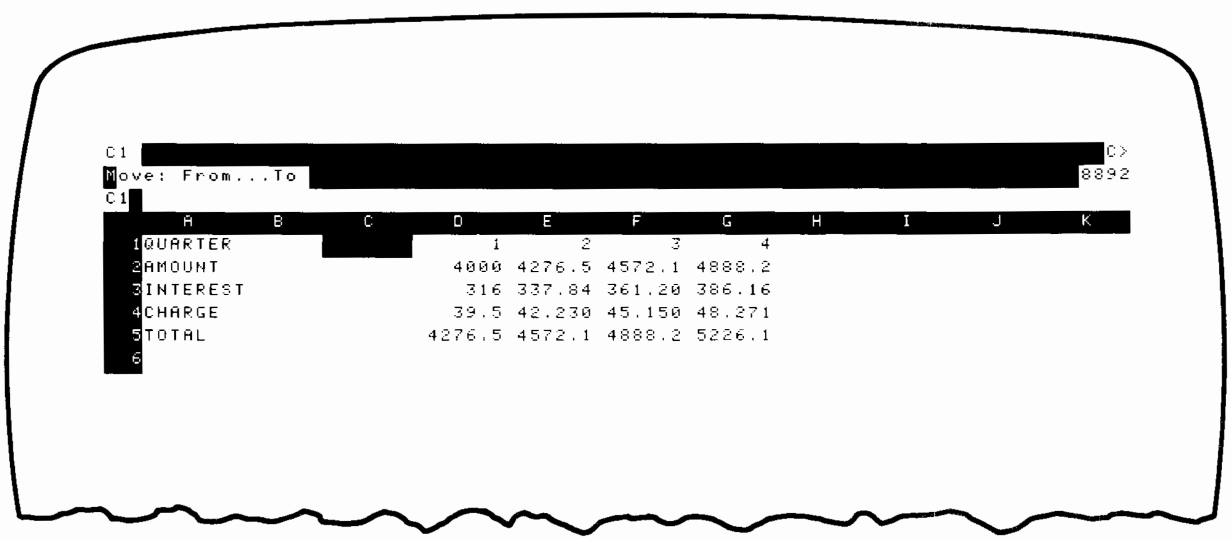
1. Type /M. The prompt line displays `Move: From...To`
2. Enter the cell coordinates of the `From` row or column. The edit line displays the cell cursor location as the `From` row or column, but this can be changed by using (BACK SPACE) and typing in another cell address, if desired.
3. Enter a three-dot ellipsis (this can be entered by typing a single period) followed by the `To` coordinates. The `To` row or column address should be the destination row or column *plus one position* for a move right or down. The `To` row or column address should be the actual destination row or column for a move left or up.
4. Type (END LINE), (CONT), or (:) to execute the command.

To move a column, the `From` and `To` rows must be the same: thus, /M A3...G3 moves the contents of column A to column F. To move a row, the `From` and `To` columns must be the same: thus, /M A3...A7 moves the contents of row 3 to row 6.

Example. Let's move the *quarter* row from row 1 to row 5 so it will follow the *total* row. Since this is a move down, the `To` coordinates should be on row 6:

Press (>) C1 (END LINE) /M

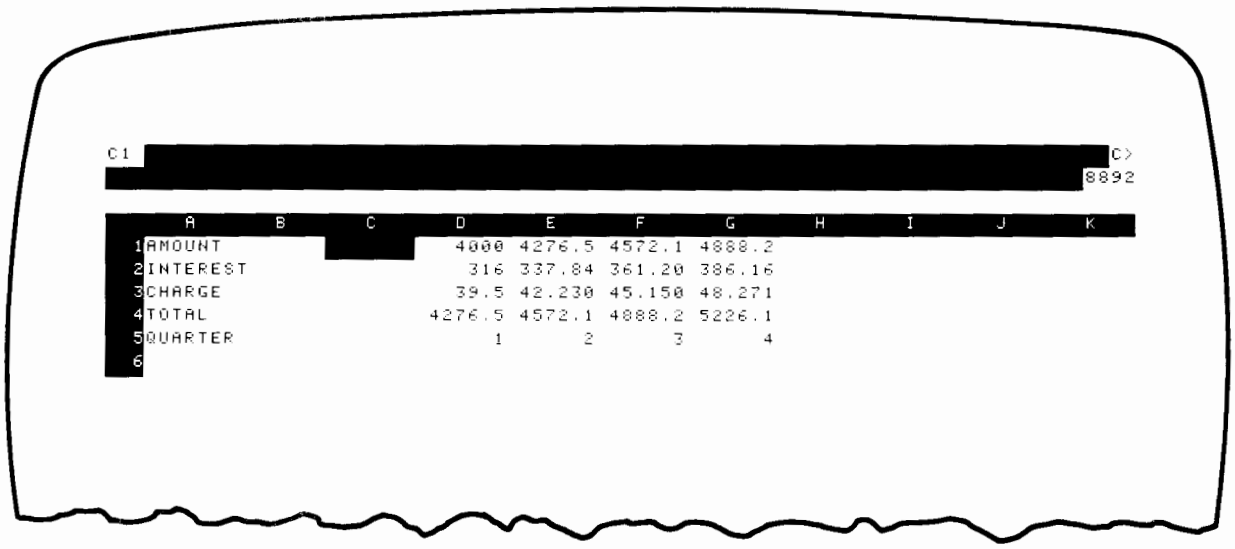
VisiCalc Display



The prompt line is asking for the From and To coordinates; our From coordinates are already on the edit line. (We could edit these coordinates with BACK SPACE if we wanted.)

Press .C6 END LINE

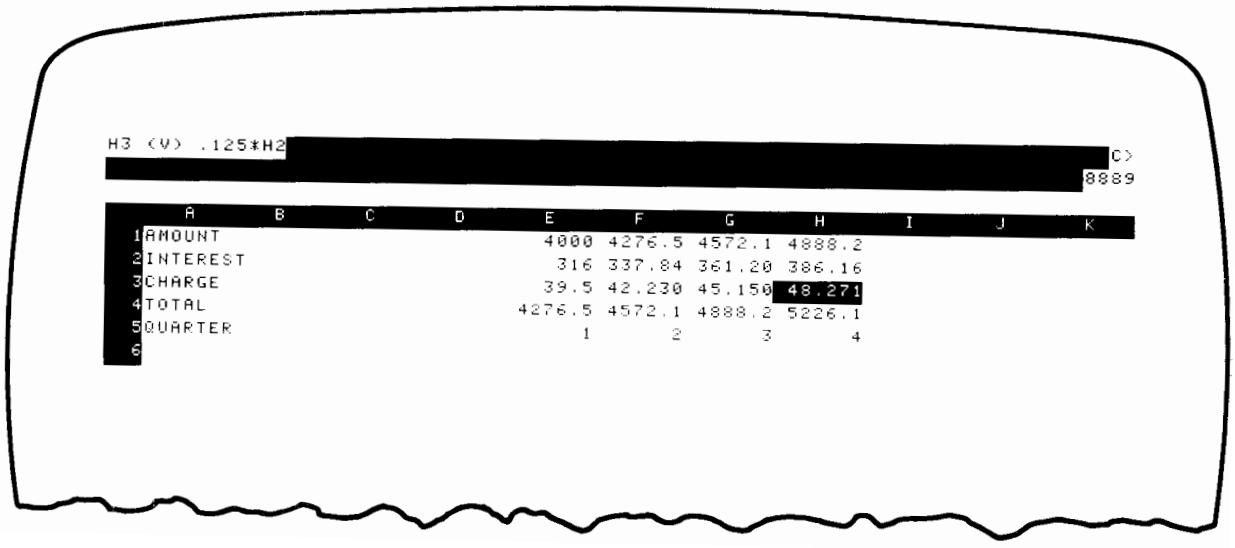
VisiCalc Display



Now we'll move column H (a blank column) to column C to increase the spacing. Since this is a move to the left, the To coordinates should be on column C:

Press >H3 END LINE /M .C3 END LINE

VisiCalc Display



Section 4

Functions and Formulas

This section outlines the mathematical functions you can use in VisiCalc values, and gives information about the numbers and labels used in VisiCalc. For further information about any Series 80 computer functions or notation, refer to the owner's manual for the computer.

Pointing the Cell Cursor

As you write formulas onto the VisiCalc worksheet, you can use the cell cursor to select cells for value references. You simply use the cell cursor in the middle of a value entry to fill in the cell coordinates as you write a formula.

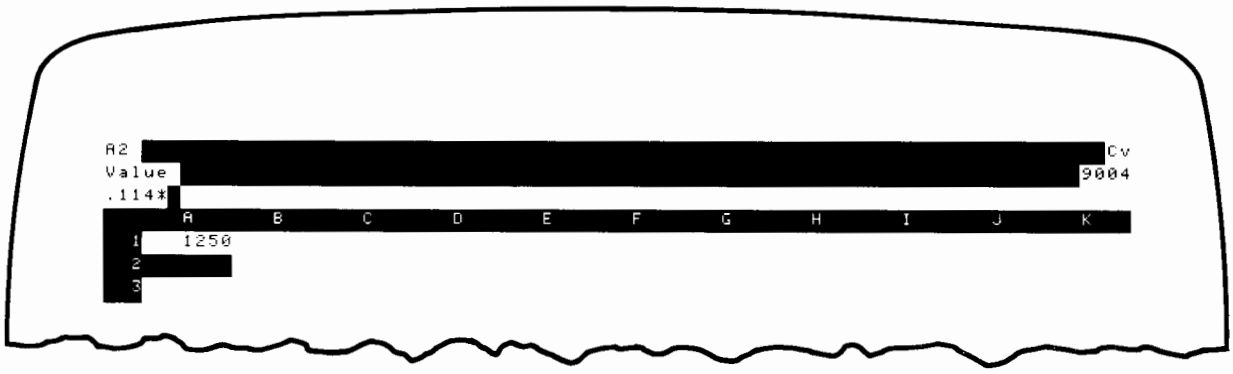
The procedure is as follows:

1. You set the cell cursor to the cell where you want the formula to appear.
2. Begin typing in the formula, to set the value mode and obtain an entry on the edit line.
3. When you come to a place where you need a cell coordinate, just move the cursor to that cell, then continue typing the rest of the formula. The cell coordinates will appear in the formula.
4. When you terminate the entry by pressing [END LINE] or [CONT], the cell cursor appears at the cell where you were entering the formula.

Example. Place the number 1250 in cell A1. Then place a formula to calculate 11.4% of A1 in cell A2:

Press /CY 1250 [↓] .114 *

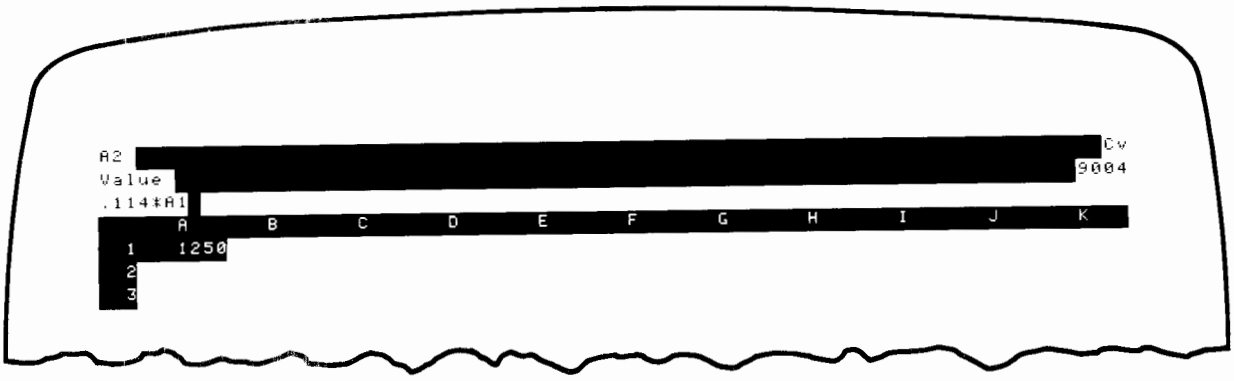
VisiCalc Display



We could continue by typing the coordinates A1. But instead, we'll point the cell cursor to obtain the coordinates A1 in the formula:

Press ↑

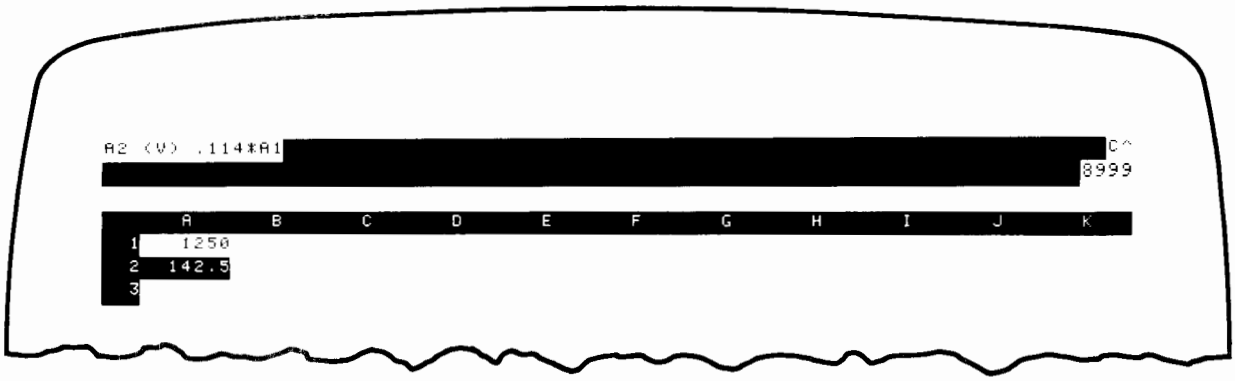
VisiCalc Display



Look at the formula on the edit line. It's exactly the formula we need: .114 * A1. We know the formula will be loaded into cell A2 because the entry contents line indicates A2. So all we need to do now is press END LINE:

Press END LINE

VisiCalc Display



The idea of moving the cell cursor as you write a formula may seem a little strange at first, and if you wish you can always type the cell coordinates yourself. But as you gain experience and familiarity with VisiCalc, you'll probably find that the technique of moving the cell cursor to the cells you want will become easier and more natural. In time, you'll find that you can almost forget about coordinates entirely, and think in terms of the relative positions of numbers and formulas on the worksheet.

Expressions and Numbers

Generally, an expression in VisiCalc consists of a series of *operands* (numbers or expressions which evaluate to numbers) separated by arithmetic *operators*. Each operand can be one of the following:

- A number, optionally with a decimal point and/or an exponent.
- A value reference, obtained either by cursor movement or by typing the cell coordinates.
- A function reference, with zero or more arguments in parentheses.
- An expression in parentheses. (Such a subexpression is evaluated first.)
- Any of the above, preceded by a + or − sign.

Each operator can be one of the following:

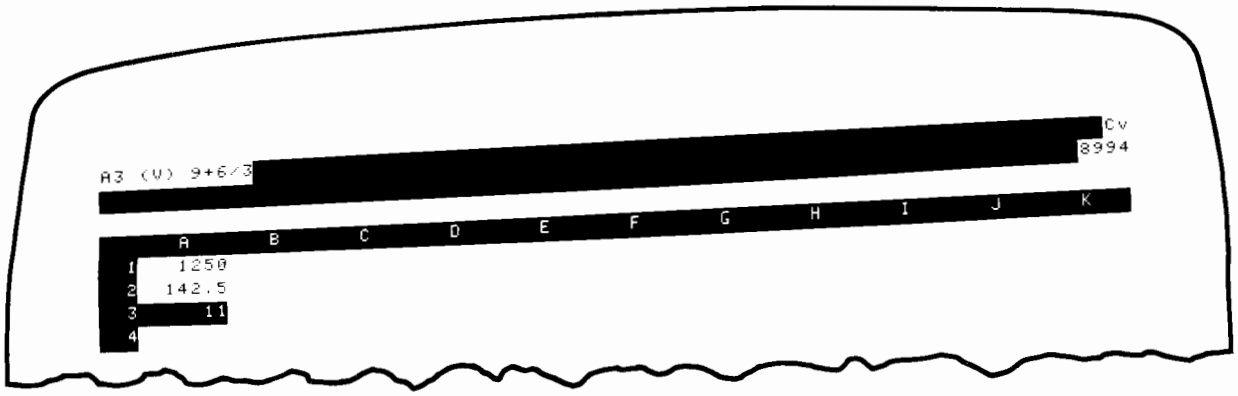
- + *Addition.*
- − *Subtraction.*
- * *Multiplication.*
- / *Division.*
- ^ *Exponentiation.*
- DIV or \ *Integer division.* (Truncates digits to the right of the decimal point after division.)
- MOD *Modulo division.* (Returns the remainder as a result of division.)
- A logical operator such as AND, OR, EXOR, or NOT, or a relational operator such as < or >.

Mathematical Hierarchy

In the examples from previous sections, we have used only simple formulas (or expressions) whose meanings have been clear. As you begin to write more complex expressions involving several arithmetic operations, the way in which such expressions should be evaluated may not be so obvious. For example, to evaluate the expression 9 + 6 / 3, should we first add 9 to 6 giving 15 and then divide by 3 to obtain 5; or should we first divide 6 by 3 giving 2, and then add 9 to obtain 11? Try it:

Press ↓ 9 + 6 / 3 END LINE

VisiCalc Display

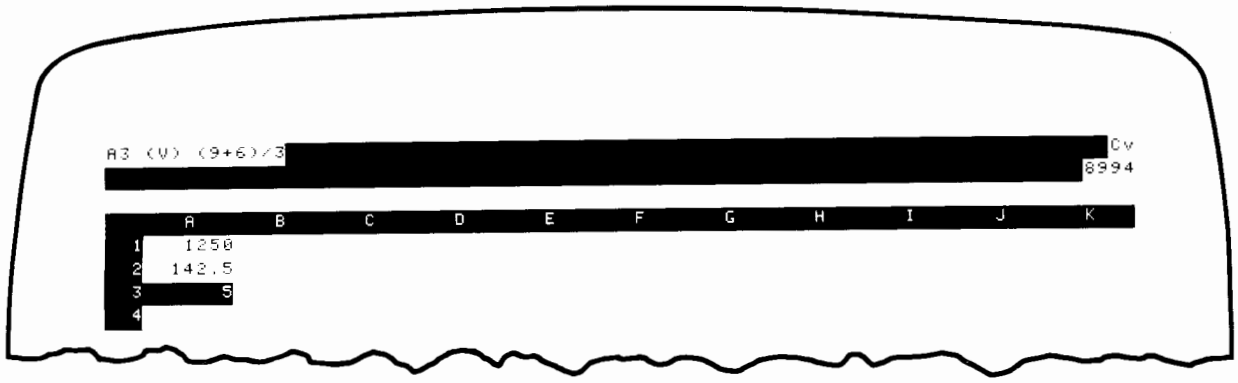


As you can see from the answer, 11, in cell A3, VisiCalc evaluated the expression as 9 + (6 / 3). VisiCalc operates like languages such as BASIC and FORTRAN; it always evaluates expressions so that multiplication and division are performed first, followed by addition and subtraction.

You can change the order of evaluation of arithmetic operations in an expression by using parentheses. For example, to clear cell A3 and then replace its contents with the result of (9 + 6) / 3:

Press /B END LINE (9 + 6) / 3 END LINE

VisiCalc Display



If you are in doubt about how an expression will be evaluated by VisiCalc, add parentheses to clarify your understanding. If you add unneeded parentheses, they are automatically removed when the expression appears on the entry contents line. Parentheses may be nested to any depth, so even an expression such as 700 + ((100 − (35 * 45)) / (11 * 12)) can be easily evaluated by VisiCalc.

The mathematical hierarchy in VisiCalc is the same as that of the Series 80 Personal Computer. For further information on mathematical hierarchy, consult the owner's manual for your computer.

Scientific Notation

If a number in a value or value reference is followed by an E and another number, as in the case of 6.02E6, it means that the first number is multiplied by a power of 10. So 6.02E6 should be read as 6.02×10^6, or 6,020,000.

For example, clear the worksheet and type in the number 999999:

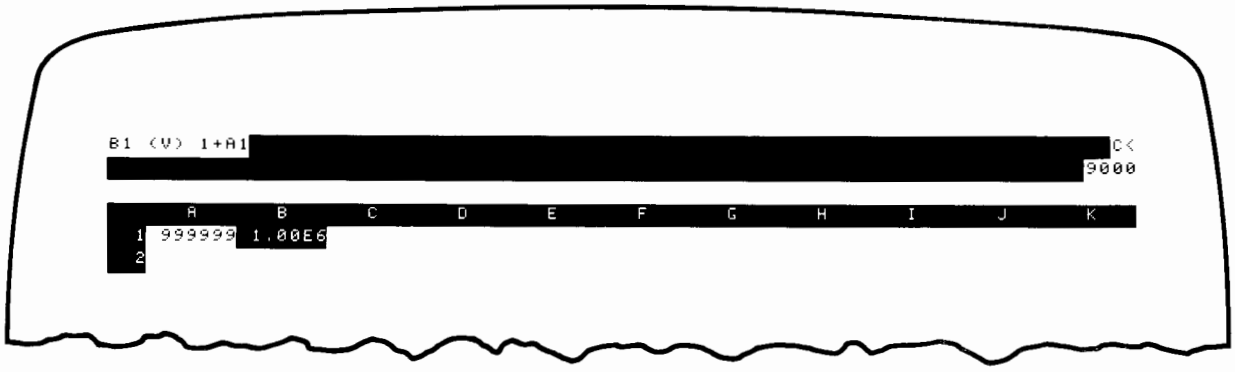
Press /CY 999999

VisiCalc Status Area

This is the largest number that can be displayed in a column seven characters wide (with a leading blank character). Now move the cell cursor to cell B1 and type 1 + A1:

Press → 1 + ← END LINE

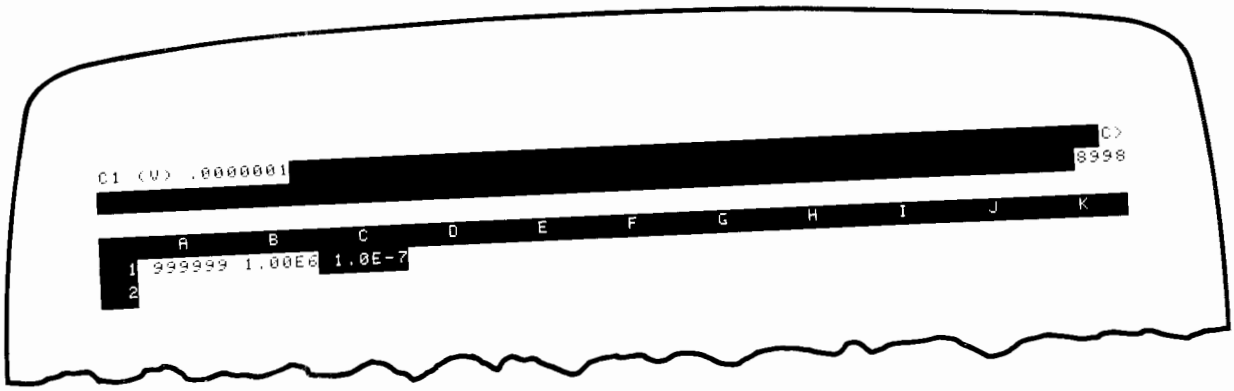
VisiCalc Display



The calculated result, 1 + 999999 or 1000000, is too large to display in ordinary form at B1, so VisiCalc has switched to scientific notation. The number appears as 1.00E6, meaning "1 times 10 to the 6th power", or "1 followed by 6 zeros." Scientific notation can also be used to display very small numbers. At C1, type .0000001 followed by END LINE:

Press → .0000001 END LINE

VisiCalc Display



The number appears in the cell as 1.0E-7, meaning "1 times 10 to the −7th power," or "1 with the decimal point moved left 7 places."

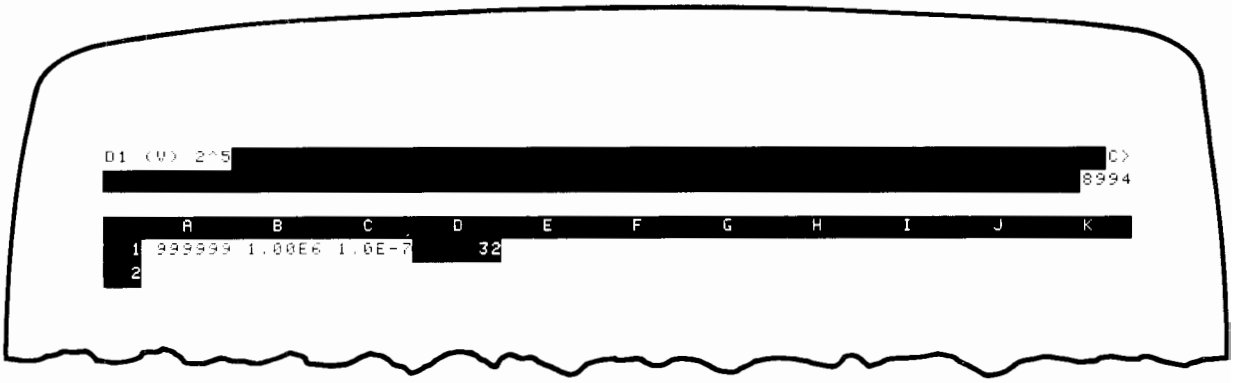
When a number is displayed in the general format (the format used when VisiCalc is first loaded), VisiCalc will automatically shift between conventional and scientific notation as required to display the value with the greatest precision.

Exponents

The exponentiation operator, ^, lets you calculate numbers to "powers." For example, to calculate "2 to the 5th power" (or $2 \times 2 \times 2 \times 2 \times 2$), you need to type only a few keys:

Press → 2 ^ 5 END LINE

VisiCalc Display



The evaluation of 2^5 yields 32.

To find a root of a number, just type the number followed by the proper fractional exponent. For example, to find the cube root of 5, you'd type 5 ^ (1 / 3).

Precision of Calculations

Later in this manual you will learn how to change the number of digits you see *displayed* in the "window" on the worksheet. But no matter how you alter the *appearance* of the worksheet numbers, VisiCalc always computes with numbers that are maintained to their full precision of 12 significant digits.

VisiCalc Functions

As you know, you can use functions as part of the formulas you write onto the VisiCalc worksheet. In fact, you can use almost the entire set of available Series 80 mathematical functions in your formulas, and you can also use a special set of functions that are unique to VisiCalc.

You will find a complete list of available Series 80 and VisiCalc functions in appendix A of this manual, as well as in the *VisiCalc PLUS Pocket Guide.*

Remember, any entry you type in that has for its first character a letter of the alphabet (such as SIN) will be seen as a *label* by VisiCalc. In order to type in the *function* SIN, you must precede it by a mathematical symbol, such as +.

An alternative is to precede the function with the "at" sign, "@", as you type it in. The @ tells VisiCalc that the entry is a value. The @ does not appear on the entry contents line.

Entry Ranges

An entry range is any number of entries in consecutive rows (such as A2, A3, A4, and A5) or consecutive columns (such as B3, C3, and D3). An entry range is specified by entering the coordinates of the first entry followed by a comma (,) and then the coordinates of the last entry. In these examples the entry ranges are (A2,A5) and (B3,D3), respectively. Cell coordinates are entered by typing them in or by "pointing the cursor."

Each built-in VisiCalc function, such as SUM, performs a calculation on the entry range of values given to it, and yields a numeric result. Functions such as SUM will operate over an entry range, such as SUM(B2,M2). Other examples of VisiCalc functions are MINR, MAXR, and AVERAGE. The numeric result of the function can be used wherever an ordinary number could be used: for example, in a function or another formula.

If you need to process a list of coordinates that are not in consecutive rows or columns, you can do it by combining a series of entry ranges, such as SUM(A4,A11) + SUM(B16,B22) + SUM(E4,H4).

In the VisiCalc functions MINR, MAXR and LOOKUP, a blank cell or one containing a label is evaluated as zero.

The SUM Function

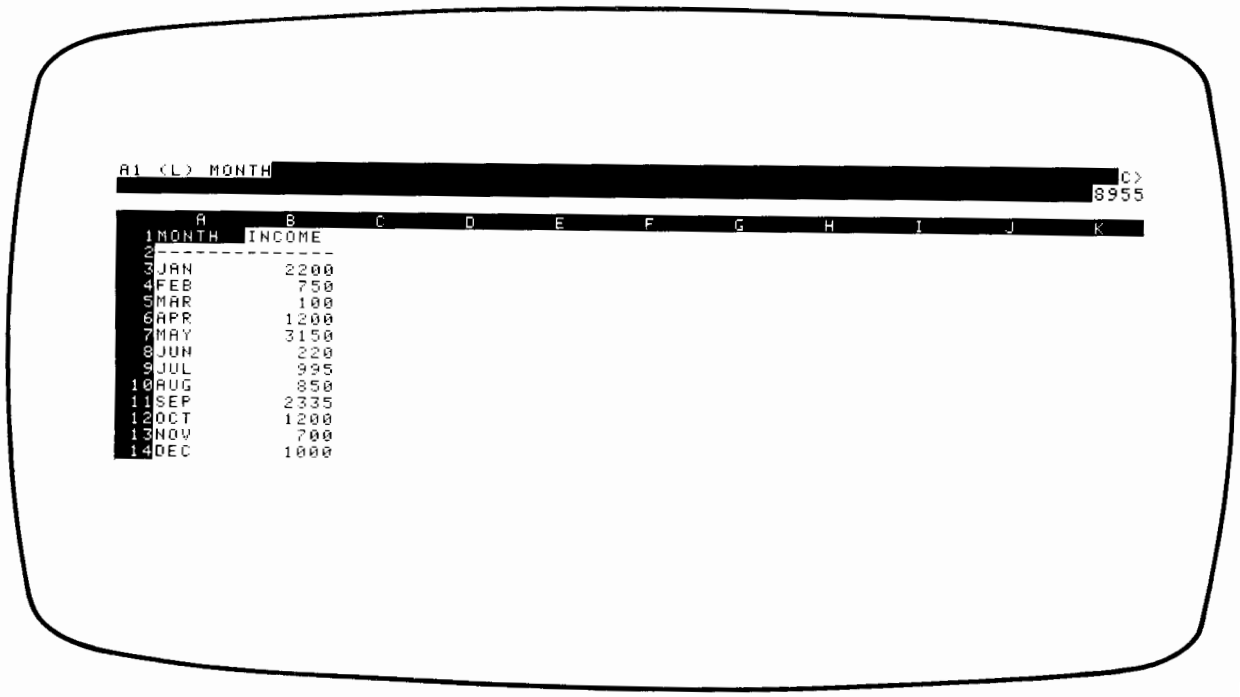
The VisiCalc function SUM adds up the values in all the cells of an entry range and computes their sum. To compute the sum of an entry range, type in the word SUM preceded by a + or @ sign, and followed by the entry range in parentheses.

Example. You are computing total business income for the year. Your monthly incomes are as follows:

January	$2200	May	$3150	September	$2335
February	$ 750	June	$ 220	October	$1200
March	$ 100	July	$ 995	November	$ 700
April	$1200	August	$ 850	December	$1000

First, set up the VisiCalc worksheet as shown here:

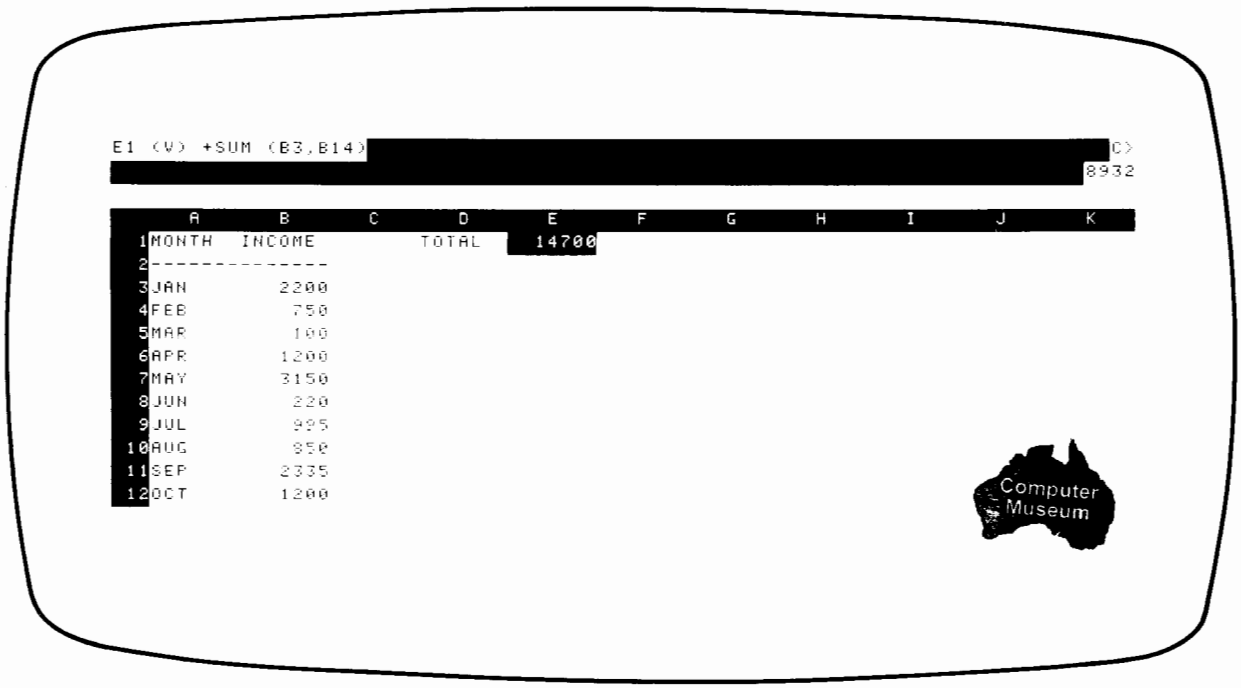
VisiCalc Worksheet



To compute the sum now, you could laboriously type in +B3+B4+B5+B6+B7+B8+B9+B10+B11+B12+B13+B14. But a faster way is to use the SUM function. Just type in SUM, followed by the entry range B3,B14 in parentheses:

Press (>) D1 (END LINE) TOTAL (→) + SUM(B3,B14) (END LINE)

VisiCalc Display



As you can see, the business income for the year was $14,700.

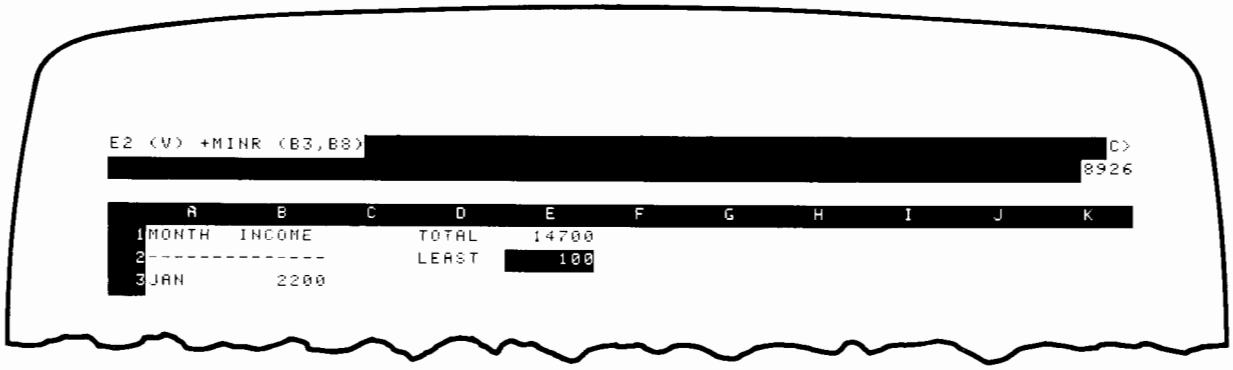
Finding Maximum or Minimum

The MAXR (*maximum in range*) function finds the maximum value in an entry range while the minimum value is found with the MINR (*minimum in range*) function. In each case, to enter the function, you type in MAXR or MINR, followed by the desired entry range in parentheses.

Example. To find the minimum monthly income in the months January through June:

Press (>) D2 (END LINE) LEAST (→) + MINR(B3,B8) (END LINE)

VisiCalc Display

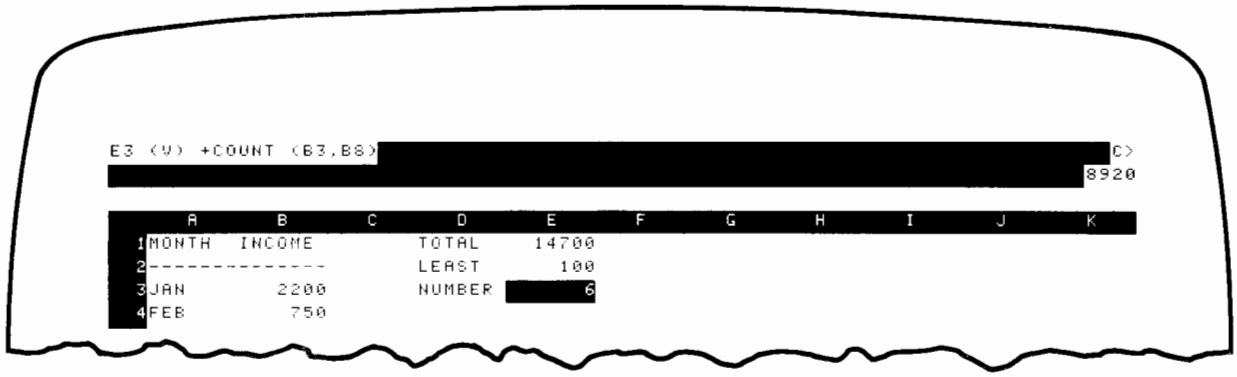


Counting Entries

The function COUNT followed by an entry range in parentheses returns the number of entries (cells that contain arithmetic values) in that range. For example, to find the number of entries used by the entry range B3,B8:

Press (>) D3 (END LINE) NUMBER (→) + COUNT(B3,B8) (END LINE)

VisiCalc Display



As we expected, the number of entries was 6. (Notice that COUNT(B1,B8) would also return a value of 6, since only cells B3 through B8 in that range contain arithmetic values.)

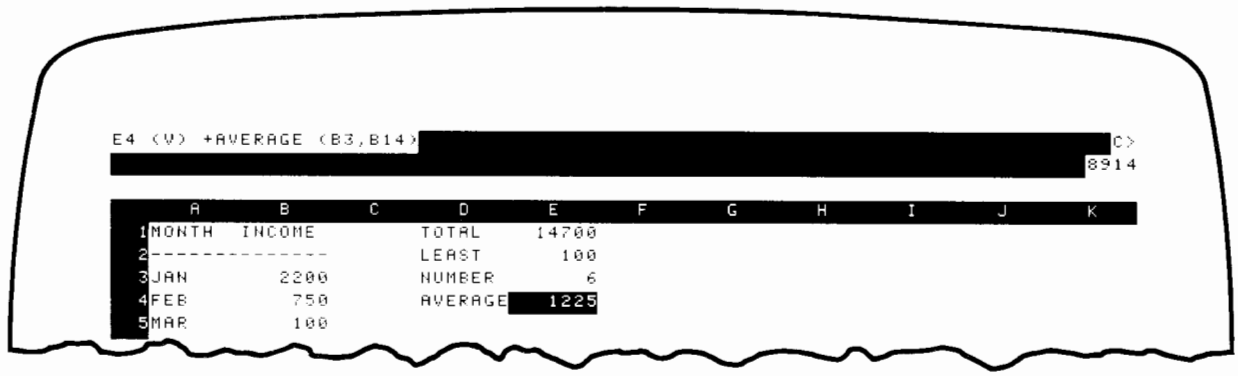
Computing Average

The AVERAGE function computes the *average* (or arithmetic mean) of the values in an entry range. To enter the function, just type in AVERAGE followed by the entry range in parentheses.

Example. To find the average monthly income for the business in the previous example:

Press (>) D4 (END LINE) AVERAGE (→) + AVERAGE(B3,B14) (END LINE)

VisiCalc Display



The average monthly income was $1225.

Mean

MEAN is a VisiCalc function that computes the *mean* of values contained in a range of cells. The result is exactly the same as the AVERAGE function. To compute the mean of the values in cells C3, D3, E3, F3, and G3, for example, you would enter the function MEAN(C3,G3).

Standard Deviation

You can calculate the sample standard deviation of the values contained in a range of cells by using the STDEV (*standard deviation*) function. Just enter the function name followed by the cell range in parentheses; for example, STDEV(F5,F90).

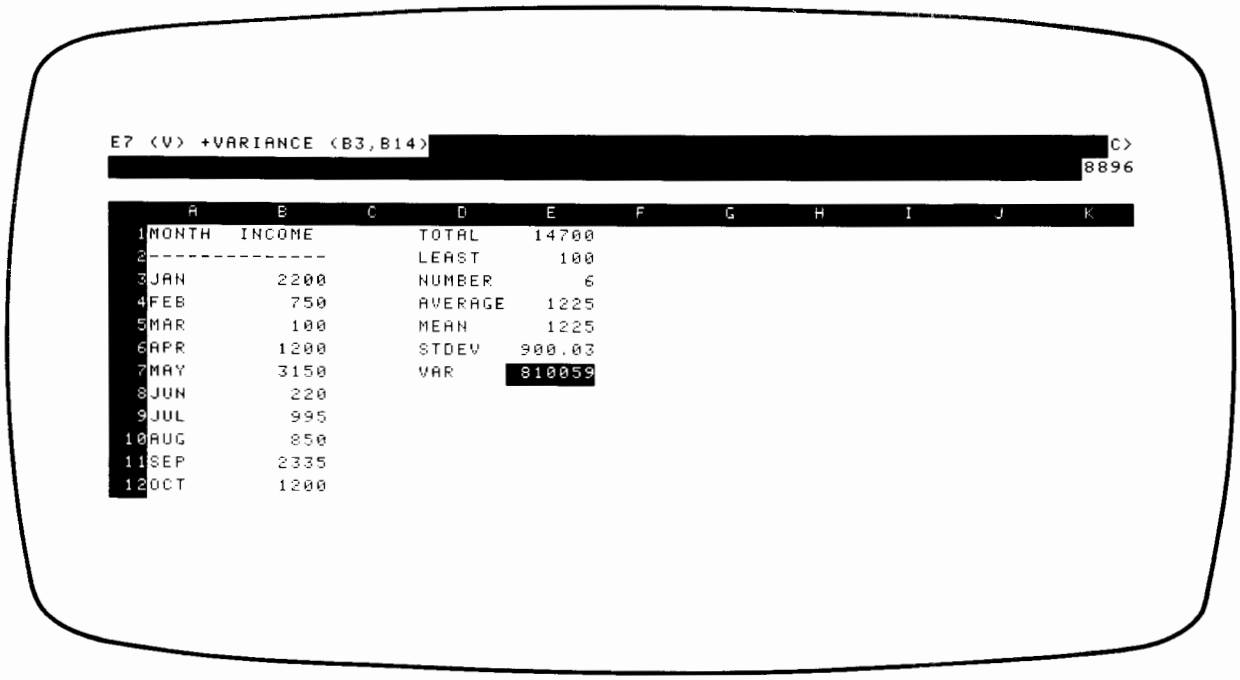
Variance

To calculate the sample *variance* of the values contained in a range of cells, use the VARIANCE function followed by the entry range; for example, VARIANCE(K5,T5).

Example. To calculate the mean, standard deviation and variance of an entry range:

Press (>) D5 (END LINE) MEAN (→) + MEAN(B3,B14) (END LINE) (>) D6 (END LINE) STDEV (→) + STDEV(B3,B14) (END LINE) (>) D7 (END LINE) VAR (→) + VARIANCE(B3,B14) (END LINE)

VisiCalc Display



Propagating NA and ERROR

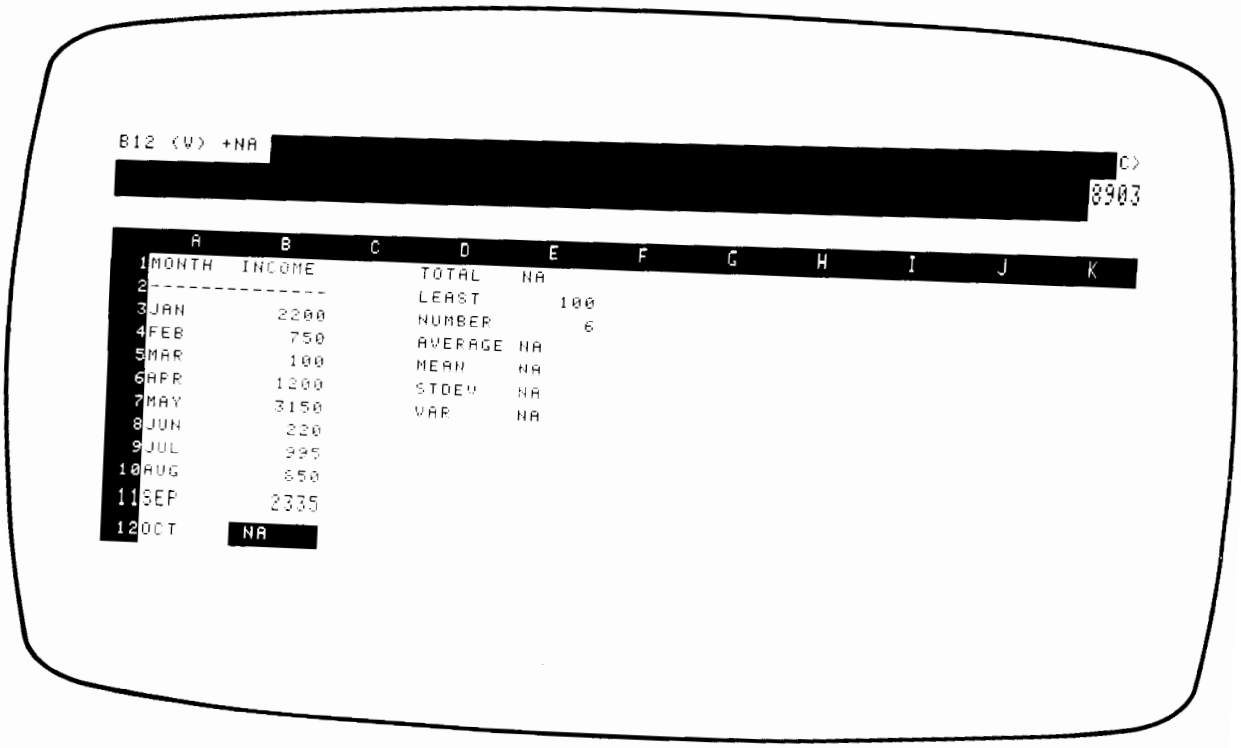
If you enter an incorrect formula onto the worksheet (such as attempting to divide a value by zero), or if an error is caused by overflow or underflow of a number as values on the worksheet change, the affected cell will display ERROR. In addition the error will be "propagated" throughout the sheet—that is, any formula or value reference which depends on the contents of the incorrect cell will also display the word ERROR when viewed through the CRT "window". You can also type + ERROR into a cell, and the word ERROR will propagate.

Similarly, if a value needed for a particular cell is *not available,* you can simply type in + NA. Like ERROR, the NA display is propagated over the entire worksheet, wherever there is a value or formula that depends on the contents of the cell.

Example. In the business income example in this section, suppose that the value for October's income was not available. To see what happens to the worksheet:

Press (>) B12 (END LINE) + NA (END LINE)

VisiCalc Display



As you can see, the NA propagates to every cell containing a formula or value reference that depends on the contents of cell B12. Notice that the contents of cells E2 and E3 are unchanged, because the values of the functions in them depend on the contents of cells in the range (B3,B8). If you type another number into cell B12, all cells with NA in them will again contain values.

In addition to mathematical errors that are propagated in VisiCalc, there are also system errors that can cause the VisiCalc program to halt operation. A list of these errors may be found in the owner's manual for the computer.

Net Present Value

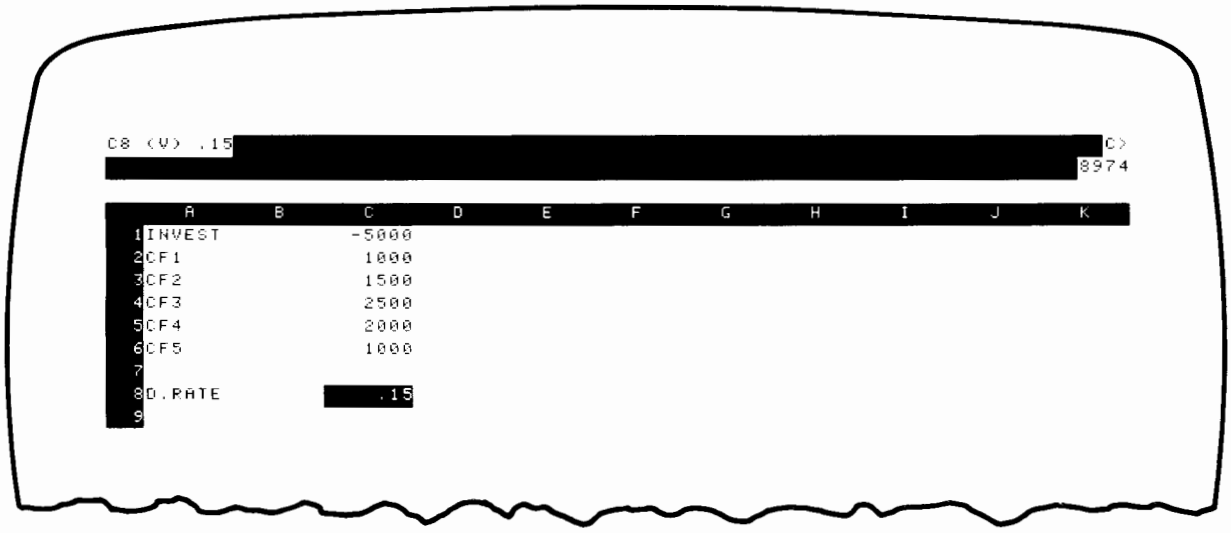
The VisiCalc function NPV calculates the *net present value* of a series of cash flows. The function is typed in as NPV(*discount rate, first cell of range, last cell of range*).

The first argument is a single expression specifying a discount rate in decimal form, such as .15 for 15% per period. The second and third arguments are an entry range; the first entry in the range is the cell containing the initial investment or initial cash flow, the second entry is the cash flow at the end of the first period, etc. The result of the function is the net present value of the cash flows in the range, discounted at the rate specified by the first argument.

As with all financial functions on VisiCalc, the cash flow sign convention should be observed: cash received has a positive sign, while cash paid out has a negative sign.

Example. Suppose that you have a project which requires an investment or cash expenditure of $5000 at the beginning, and which is expected to generate cash over a period of five years. Set up your VisiCalc worksheet as shown:

VisiCalc Worksheet

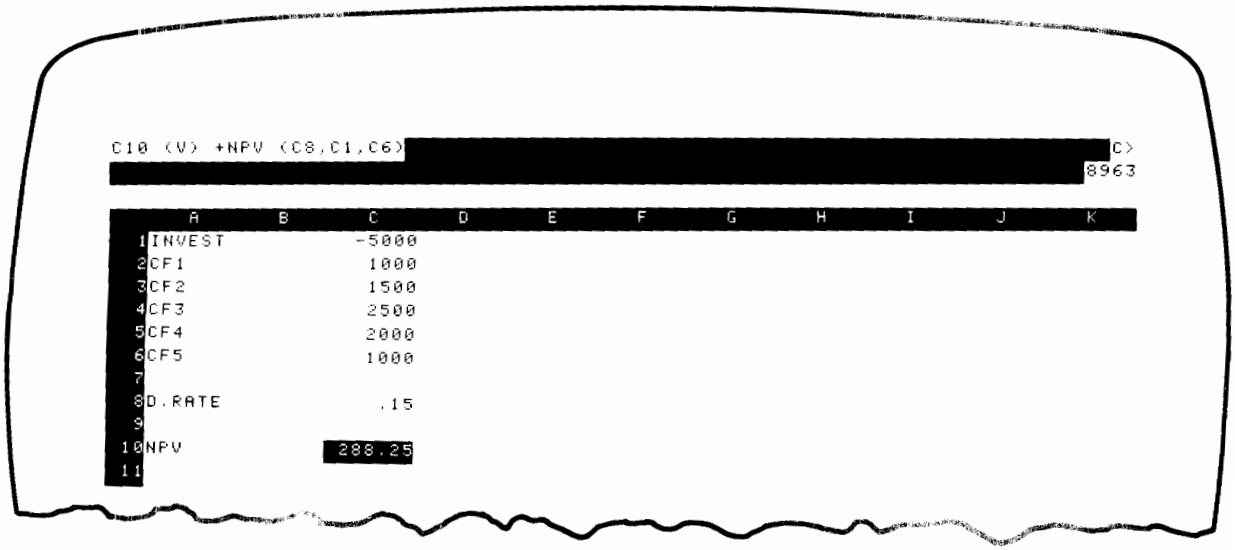


The initial investment, entered in cell C1, is $5000. The cash flows are entered in cells C2, C3, C4, C5, and C6. The discount rate which we have labeled D.RATE is .15 (that is, 15%), and is entered in cell C8.

To compute the net present value of this series of cash flows:

Press (>) A10 (END LINE) NPV (→) (→) + NPV(C8,C1,C6) (END LINE)

VisiCalc Display

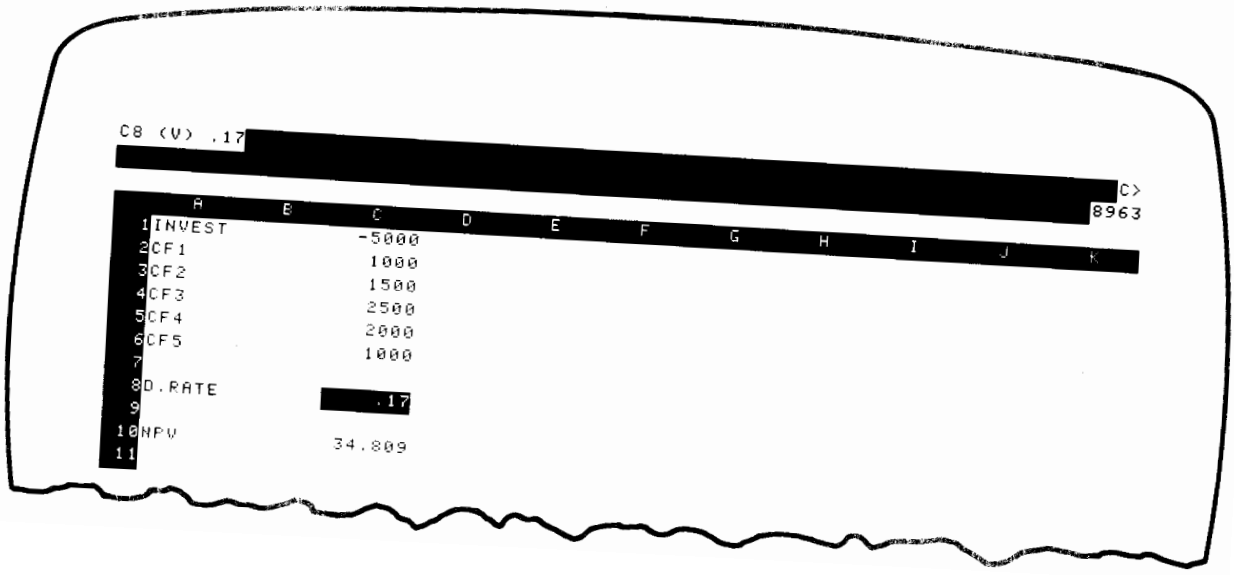


This causes the $1000 cash flow in the first year to be discounted by 15%, the $1500 cash flow in the second year to be discounted twice, etc. The result at C10 should be $288.25.

Now change the discount rate to 17% to see the effect on net present value:

Press (>) C8 (END LINE) .17 (END LINE)

VisiCalc Display



Discount

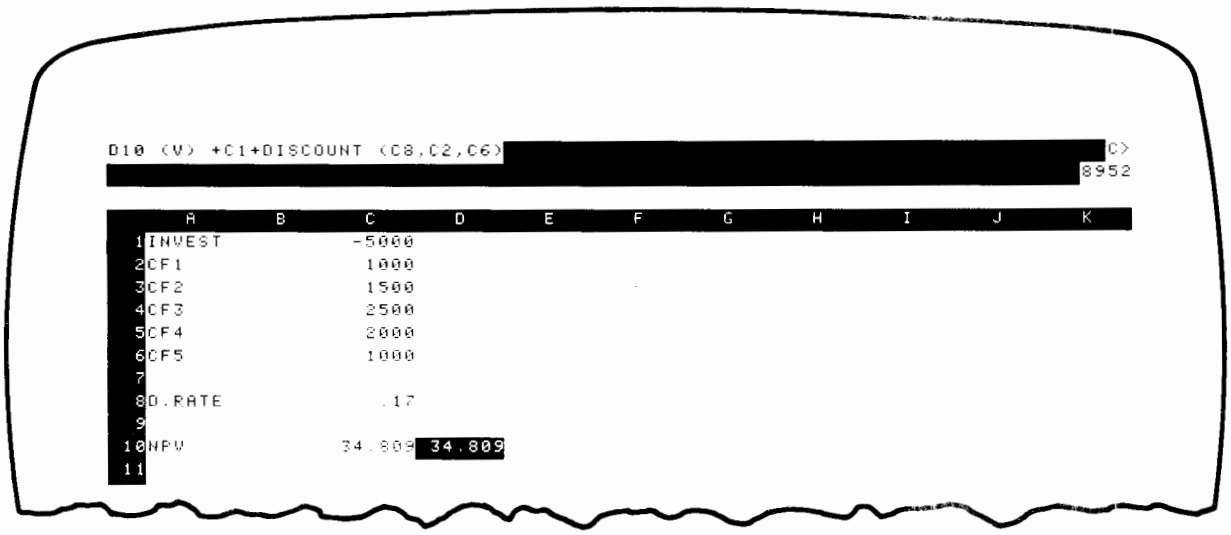
The *discount* function, DISCOUNT, is similar to NPV except that the initial investment is not part of the entry range.

The form of the function is DISCOUNT(*discount rate, first cell of range, last cell of range*). The first entry of the range is the cell containing the cash flow at the end of the first period, the second entry is the cell with the cash flow at the end of the second period, etc. If the initial investment is added to the result of the DISCOUNT function, the sum is equivalent to the result of NPV. DISCOUNT can be used where the initial investment is in a cell in a different row or column and cannot be part of the entry range for the function.

Example. To calculate net present value for the example above by using DISCOUNT:

Press (>) D10 (END LINE) + C1 + DISCOUNT(C8,C2,C6) (END LINE)

VisiCalc Display



Notice that the answer in D10 is the same as + NPV(C8,C1,C6).

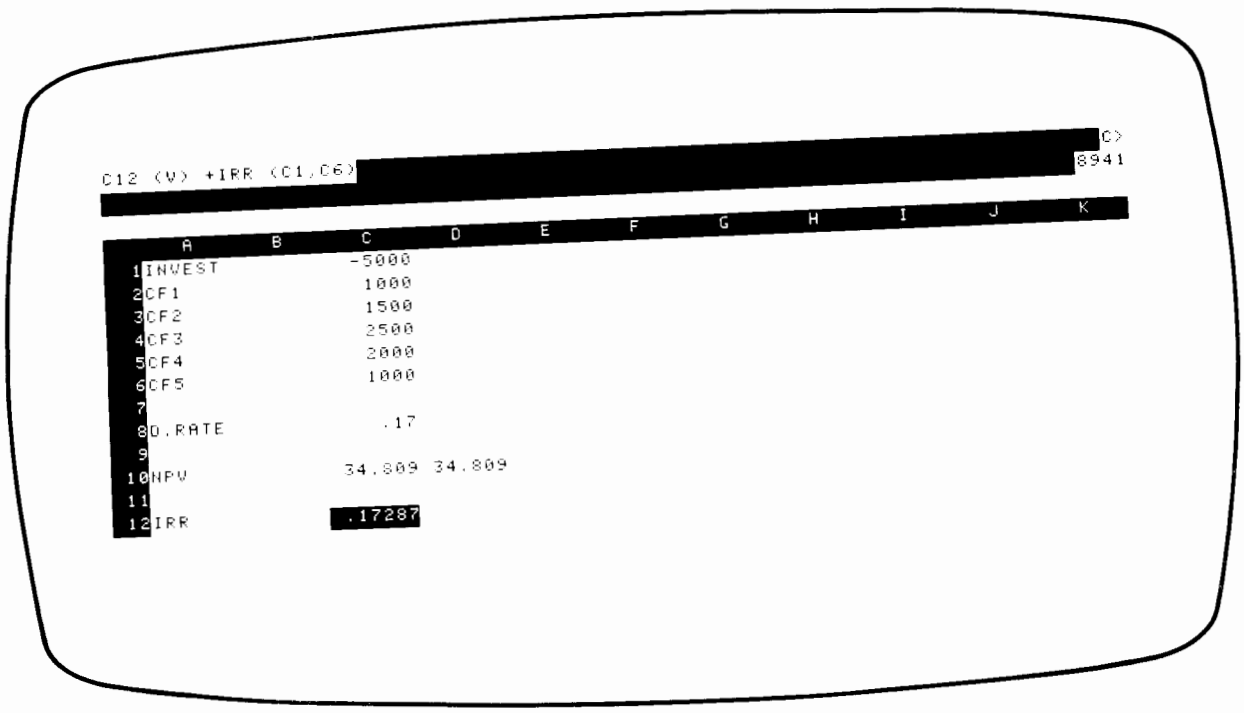
Internal Rate of Return

The IRR (*internal rate of return*) function returns the internal rate of return of a series of cash flows. It uses the range of cash flows as the arguments; for example IRR(A1,A9), or IRR(C5,M5). The first entry in the range is the initial cash flow or investment, the second entry is the cash flow at the end of the first period, etc.

Example. To find the internal rate of return on your example investment:

Press (>) A12 (END LINE) IRR (→)(→) + IRR(C1,C6) (END LINE)

VisiCalc Display



As you can see, the internal rate of return on your series of cash flows is .17287, or 17.287% per year.

You'll notice that the IRR calculation takes more time than NPV. This is because IRR is an iterative calculation, arriving at a solution after computing a series of successively better approximations. As the number of cash flows increases, the time to calculate a result also increases.

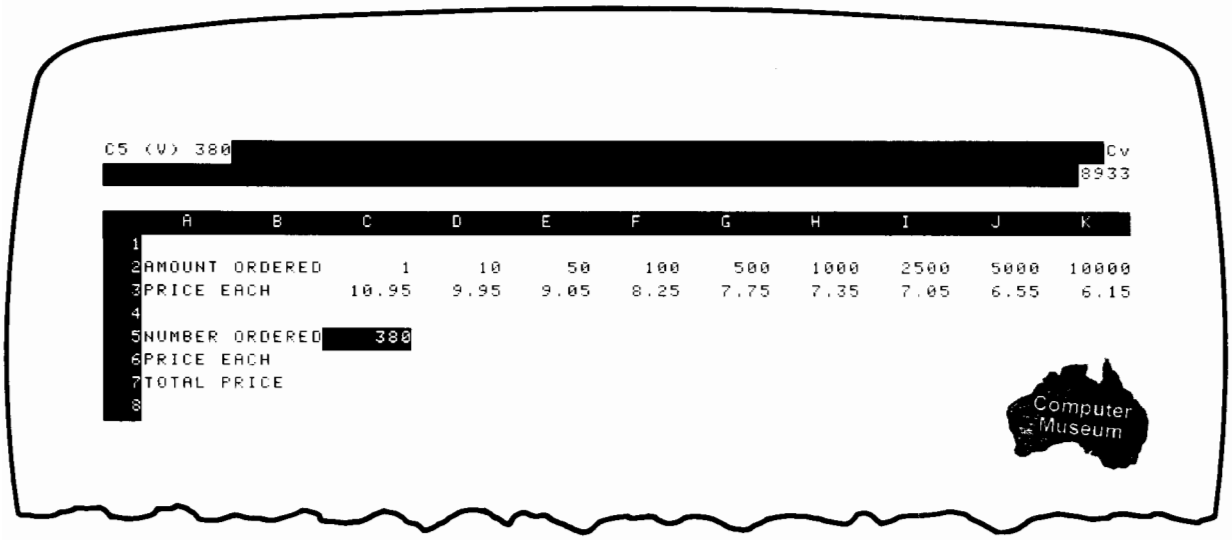
Note: If the IRR calculation cannot converge to a solution, the result of the function is ERROR.

The LOOKUP Function

The *search* function, LOOKUP, is another VisiCalc function that accepts three arguments. To set up the function, there must first be two rows of values or expressions, one above the other, or there must be two columns of values or expressions side by side on the worksheet. When VisiCalc evaluates the function LOOKUP(*x,range*), it compares the value x to the values of successive entries in a range row or column, and selects as the result of the function the corresponding value from the column immediately to the right, or the row immediately below, the entries in the range row/column. The values in the range must be in ascending order, and the result is the value corresponding to the last entry in the range row/column that is less than or equal to x, before an entry greater than x is found. If the first entry in the range row/column is greater than x, the result of the function is NA (*not available*).

Example. Clear the worksheet and set up a table showing price per unit of merchandise varying according to the quantity ordered. Your worksheet should look like the one shown:

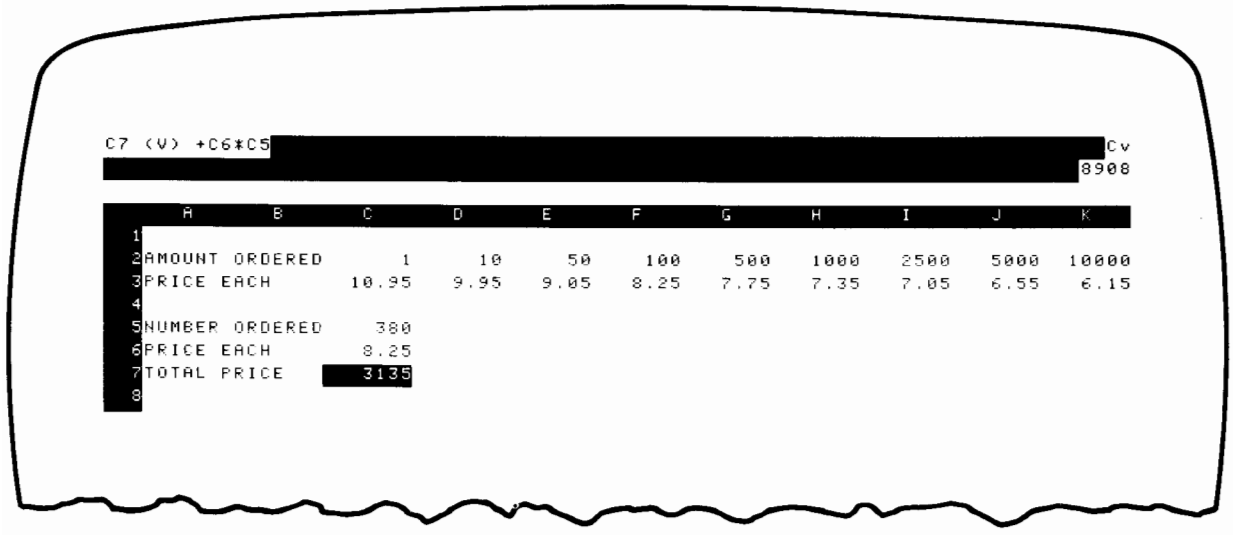
VisiCalc Worksheet



Now suppose you decided to order 380 units. This becomes the first argument of the LOOKUP function. The range row is row number 2 (AMOUNT ORDERED) and the result row is row number 3 (PRICE EACH). So the function is typed in as + LOOKUP(C5,C2,K2), where the search value of 380 is in cell C5:

Press (>) C6 (END LINE) + LOOKUP(C5,C2,K2) (END LINE) (↓) + C6 * C5 (END LINE)

VisiCalc Display



As you can see, the result is 8.25, since 8.25 corresponds to the value 100 in the range row (AMOUNT ORDERED), which is the last value that is less than or equal to 380.

Series 80 Functions and VisiCalc

In addition to the functions that are found only in VisiCalc, you can also use almost the entire set of mathematical functions on your Series 80 Personal Computer. Like the VisiCalc functions, if a Series 80 function is the first entry to a cell, you must precede it with the @ sign, or + or some other mathematical symbol, so that VisiCalc knows you are typing in a value and not a label. Unlike VisiCalc functions, Series 80 functions do not recognize entry ranges like (A3,A6). For a detailed description of any Series 80 function, you should consult your computer owner's manual.

Remember that you can use the entire set of Series 80 logical and relational operators, including =, >, <, >=, <=, <> or #, AND, OR, EXOR, and NOT. This means that powerful expressions or formulas are possible without requiring special functions. For example, you can write conditional expressions such as: 1000 * (A1 < 0) + 2000 * (A1 = 0) + 3000 * (A1 > 0). This expression translates as:

If A1 is less than 0, the cell value is 1000.

If A1 is equal to 0, the cell value is 2000.

If A1 is greater than 0, the cell value is 3000.

Note: All NOT expressions must be enclosed in parentheses when entered or edited to result in a correct answer.

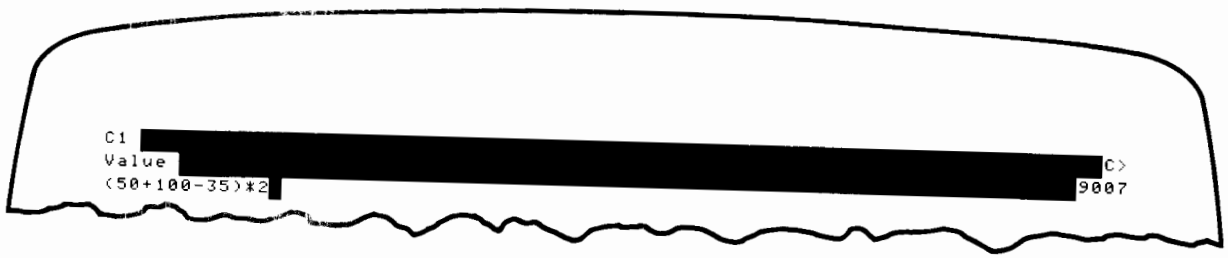
Precalculation of an Expression

A value entry may consist of a number, or of a formula or expression such as (75 + 25) * 100. By pressing [!] after writing a formula on the edit line, you can actually cause the value to be calculated *before* it is entered into a cell. When you are entering values, [!] lets you use the edit line like a simple calculator.

For example, to calculate (50 + 100 − 35) * 2, and then enter the result in cell C1:

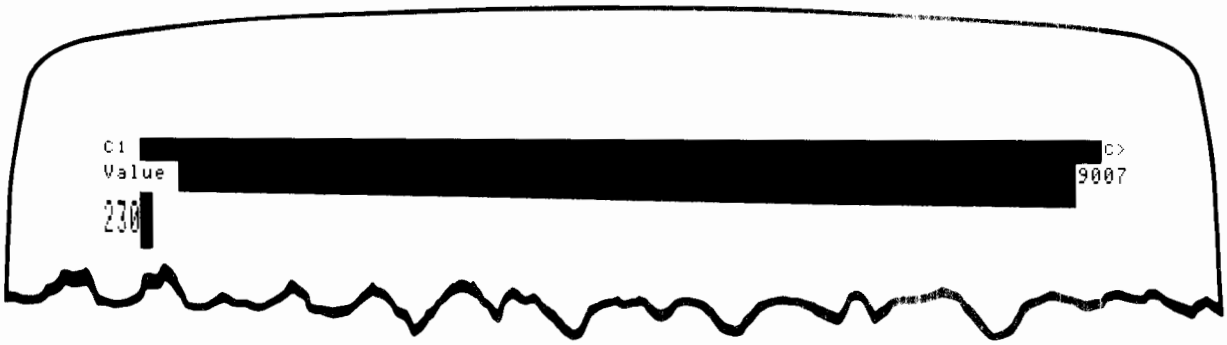
Press /CY [>] C1 [END LINE] (50 + 100 − 35) * 2

VisiCalc Status Area



Press (!)

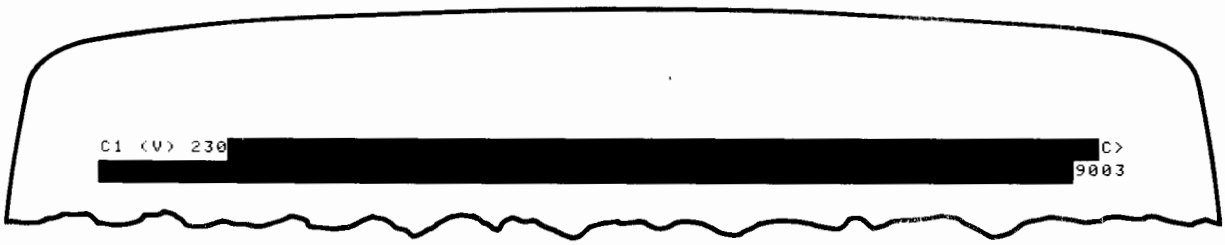
VisiCalc Status Area



Now simply terminate the entry to cause it to appear in the cell:

Press (END LINE)

VisiCalc Status Area



The (!) key can also be used to recalculate the entire worksheet at once. More about recalculation shortly.

Entering Results With (RESLT)

You can use the (RESLT) key to enter the current value of any cell into a formula or expression. As you are typing in the expression, just enter the cell coordinates of the value reference followed by (RESLT), and the *current value* of the reference is entered into the expression at that point. You can type in the value reference, of course, or you can simply "point the cell cursor" to enter the cell coordinates.

In top-level mode, (RESLT) places the value of the current cell expression on the edit line. Unlike (!), (RESLT) does not place the calculated value into the cell— (RESLT) is an editing aid only.

Recalculation

As your VisiCalc worksheets and calculations grow larger and more complex, there can be significant delays as you enter formulas into cells. This is because VisiCalc computes each formula to twelve significant digits as it is typed in and after every following data entry, then places the computed value in the cell on the worksheet. Each function such as LOG and SIN, for example, takes a fraction of a second to evaluate, and an iterative function such as IRR, or a sheet full of function references, can take several seconds to recalculate. The amount of delay increases as the amount of information on the worksheet increases.

In many cases, you don't need to have all the values recalculated every time you change an entry. The /GR (*global recalculation*) command lets you change several entries and then trigger a recalculation when you're ready to look at the results. And /GO (*global order*) specifies the order of recalculation—down the columns or across the rows.

The Recalculation Order Indicator

VisiCalc will evaluate the formulas on the worksheet in one of two possible orders: "down the columns" or "across the rows." Look again at the letter C just to the left of the direction indicator at the upper right corner of the status area on the computer's CRT screen. This is the recalculation order indicator, and it can be either C, for columnwise recalculation, or R, for rowwise recalculation. When you load the VisiCalc program or clear the sheet, VisiCalc is set to recalculate "columns first." It will evaluate first A1, then A2, A3, etc., then B1, B2, B3, etc., then C1, and so on. If you change the recalculation order to "rows first," VisiCalc will evaluate first A1, then B1, C1, etc., then A2, B2, C2, etc., then A3, and so on.

Recalculation Commands

You can change the recalculation order with the /GO command, and you can specify automatic or manual recalculation with the /GR command. When you type in the command /G, the prompt line displays Global: C O R F P B to prompt you for a further entry. The global commands are:

/GO The prompt line displays Reevaluate order: Row Column.
/GOC sets the recalculation order to be down the columns beginning with column A.
/GOR sets the recalculation order to be across the rows beginning with row 1.
Recalculation order at program start is down the columns.

/GR The prompt line displays Recalculate: Auto Manual.
/GRA sets recalculation to be automatic.
/GRM sets recalculation to be manual.
Recalculation at program start is automatic.

/GC *Global column width.* The prompt line displays Column width.

/GF *Global format command.* The prompt line displays Format: D G I L R $ *.

/GP *Global page size.*

/GB *Global background.*

The column width, format, page size, and background commands are explained in section 6 of this manual.

Automatic recalculation is set after a /CY command. However, since automatic recalculation is performed whenever a new value is entered, manual recalculation allows faster data entry than automatic recalculation. Manual recalculation of all entries is performed when all other entries or commands have been terminated (as indicated by the prompt and edit lines) and you type an exclamation point, [!].

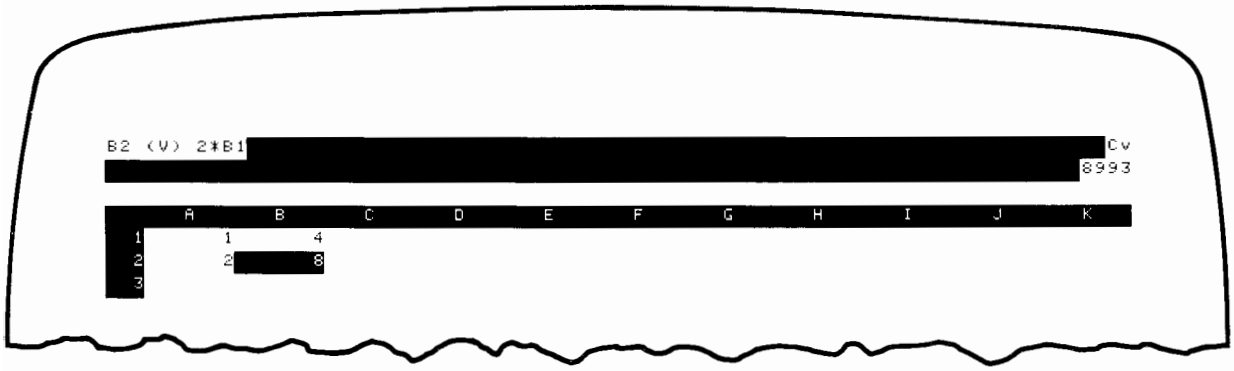
As recalculation occurs, the recalculation order indicator is highlighted, and the cell count indicator may blink.

For many problems, the choice of row-first versus column-first recalculation has no effect on the results displayed on the screen. But there are times when you must use the correct recalculation order to obtain correct results, and it's important to recognize these cases when they arise.

Let's consider an example. As you type the following formulas, think about how each entry depends on the others.

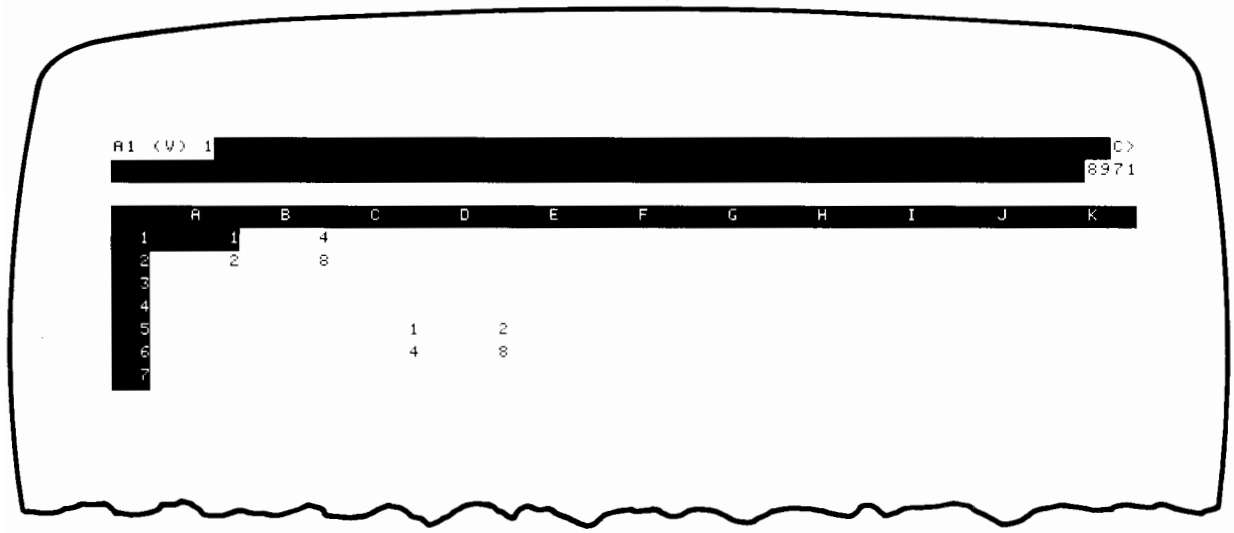
Press /CY 1 ↓ 2 * A1 END LINE > B1 END LINE 2 * A2 ↓ 2 * B1 END LINE

VisiCalc Display



Press > C5 END LINE + A1 → 2 * C5 END LINE > C6 END LINE 2 * D5 → 2 * C6 END LINE ↖

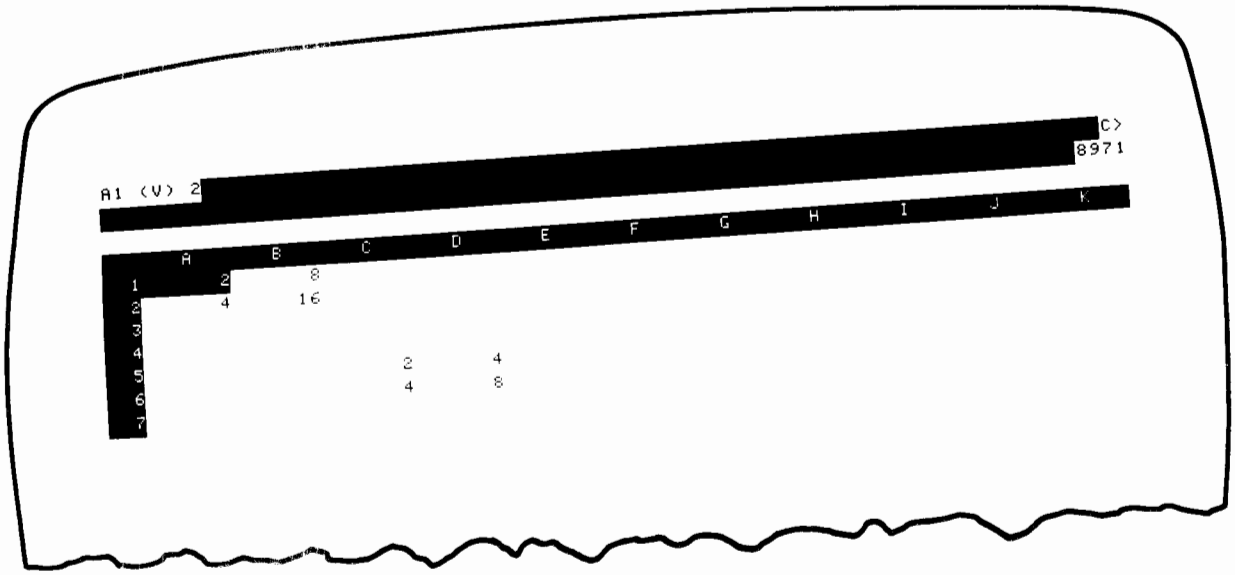
VisiCalc Display



As you can probably see, the group of entries starting at A1 must be recalculated in the order A1, A2, B1, B2 (since B1 depends on A2). The group of entries at C5, however, must be recalculated in the order C5, D5, C6, D6 (since C6 depends on D5). With the cursor at A1, type 2 (END LINE) and watch what happens:

Press 2 (END LINE)

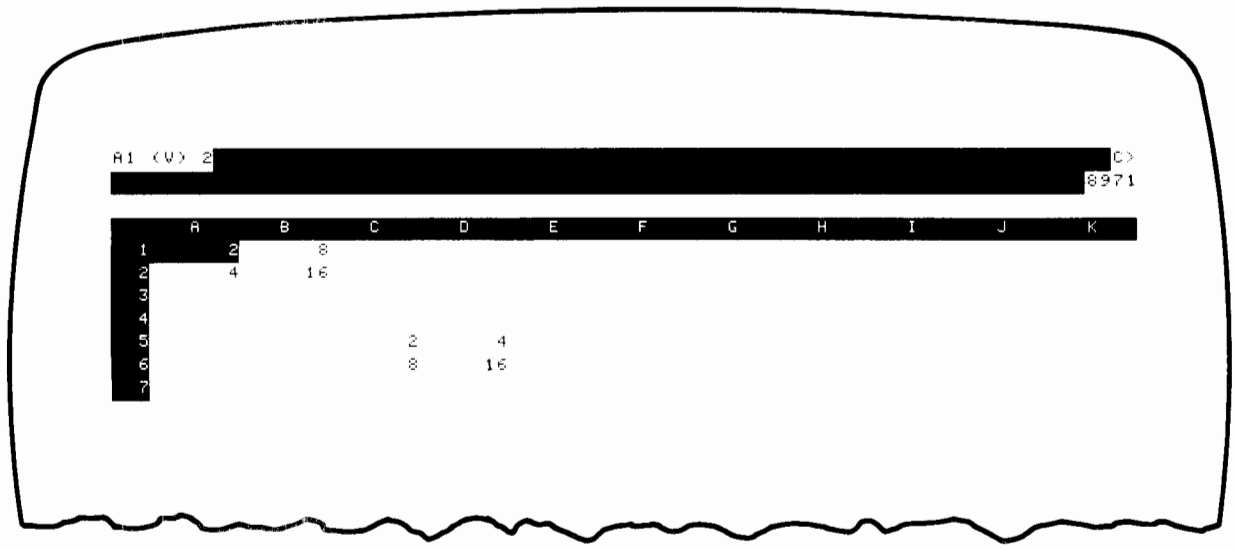
VisiCalc Display



A2 becomes 4, B1 becomes 8, and B2 becomes 16, as expected; but while C5 becomes 2 and D5 becomes 4, C6 remains at 4 and D6 at 8. The formula at D5 *was* recalculated, but this happened *too late* to affect the recalculation of C6 and D6. Now press (!) to trigger an extra recalculation:

Press (!)

VisiCalc Display

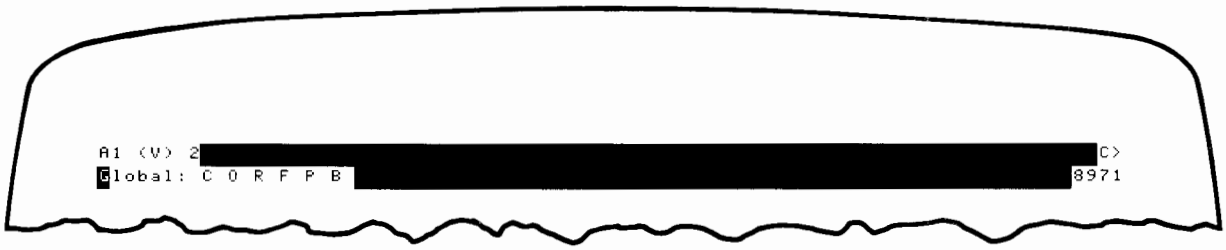


This time C6 has become 8 and D6 has become 16.

Now we'll change the order of recalculation from "columns first" to "rows first" by using the /GOR command. But first we'll specify *manual* recalculation with the /GRM command:

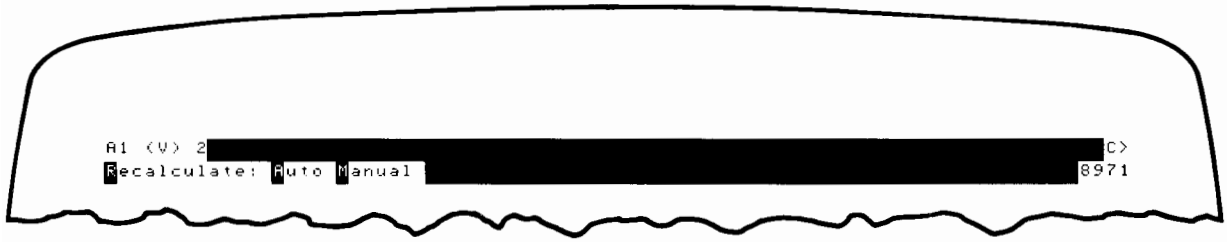
Press /G

VisiCalc Status Area



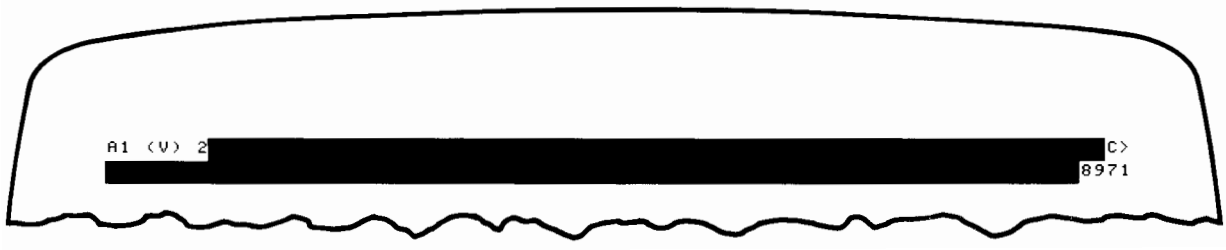
Press R

VisiCalc Status Area



Press M

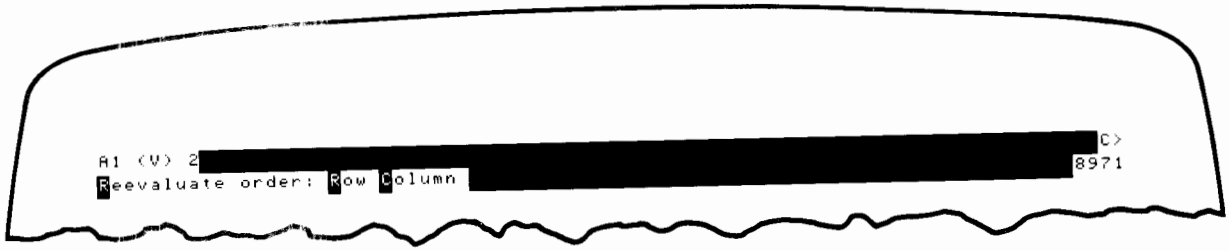
VisiCalc Status Area



Now that we've selected manual recalculation, we'll change the recalculation order to *rows* first:

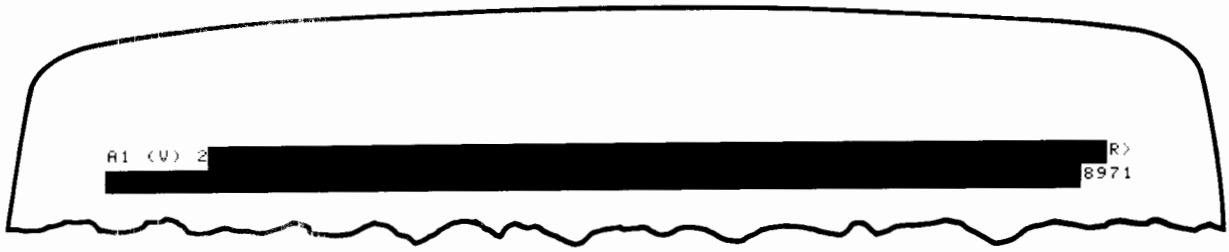
Press /GO

VisiCalc Status Area



Press R

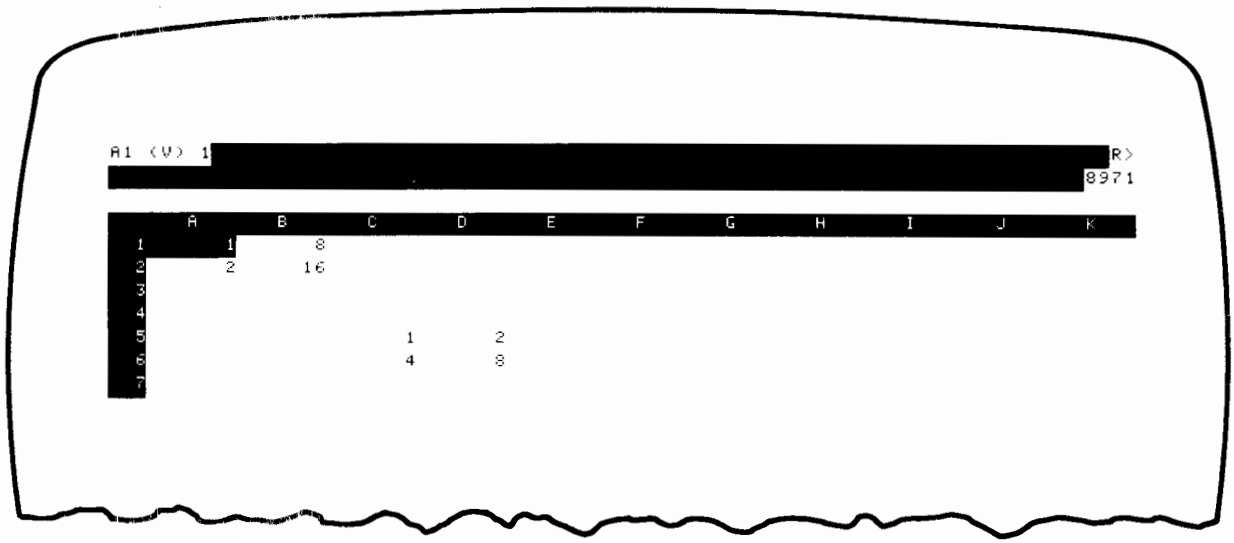
VisiCalc Status Area



Notice that the recalculation order indicator at the top right of the VisiCalc status area has changed to R for *rows*. Now type the number 1 into cell A1 again, then perform the manual recalculation with a single press of ! while you watch the VisiCalc window:

Press 1 END LINE !

VisiCalc Display



This time D5 becomes 2, C6 becomes 4, and D6 becomes 8; but while A2 becomes 2, B1 stays at 8, and B2 at 16. Our problem with B1 and B2 is similar to our earlier problem with C6 and D6.

The moral of this example is that you should plan your calculations with either columnwise or rowwise recalculation in mind, but not both. If possible, you should arrange things so that the results will be correct with either columnwise or rowwise recalculation. Then, if you decide to calculate something new that requires a particular order of recalculation, you won't be hindered by the recalculation order.

In general, try to construct your worksheet so that all cells with value references will be recalculated only *after* the cells on which they depend. This is done by locating these "dependent" cells below and to the right of all their value references. Also, be careful when creating formulas which refer to cells which, in turn, refer to other cells. Such a situation could lead to a forward or circular reference, discussed below.

If you find yourself with a problem of conflicting requirements for "row first" and "column first" recalculation, you can deal with these requirements by pressing [!] for an extra recalculation each time you change a value and look for recalculated results. But first make certain that your row and column conflict is not actually due to a "forward reference" or a "circular reference."

Forward and Circular References

VisiCalc is extremely simple and powerful to use, but there are a few problems that can occur if you are not careful about how you set up the worksheet. Two of these are *forward references* and *circular references.*

A cell with a forward reference refers to an entry which will be recalculated *after* the cell is recalculated, as in the previous example. The only way to achieve the correct results throughout the worksheet is to perform a second recalculation. In extreme cases, forward references may refer to other forward references, so that correct results can be obtained only after several recalculations.

An effect even more startling is caused by a circular reference. The value of such a formula cannot be determined with any number of recalculations!

For example, suppose that you are projecting future profits, taking into account various revenues and expenses. One of the expenses is employee salaries, and one part of salaries consists of profit-sharing. Unless you are careful, you may create a circular reference: salaries with profit-sharing depend on profits, but profits depend on expenses including salaries. (To resolve this circularity, you must calculate a figure for profits before profit-sharing is taken out.)

You can often discover forward or circular references because pressing [!] repeatedly does not give you a consistent result. You can thus use [!] to check for forward and circular references.

Once you are aware of the issues involved in recalculation, it is not difficult to avoid conflicts in the order of recalculation or forward and circular references. Generally these problems arise when you are working too quickly without a plan, or "patching" an existing layout on the worksheet. If your approach to the problem is orderly and well thought-out, it is unlikely that you will encounter any problems with recalculation.

Section 5

The Replicate Command

This section details the use of the /R, or *replicate,* command, which is used for repeating an entry across a row or column, or for repeating an entire row or column on the VisiCalc worksheet.

With this command a single cell can be replicated into either another single cell or a row or column of adjacent cells. A single row or column can be replicated into either another row or column, or into a range of adjacent rows or columns.

The replicate command is one of the most useful and powerful commands in VisiCalc. By replication, you can cause cell entries such as formulas, labels, values, or value references to be copied across rows and down columns. (Cell formats can also be replicated. More about formatting in section 6.) The replicate command can save you the time you might otherwise spend laboriously copying these expressions into each cell position.

Here is the replication procedure:

1. Position the cell cursor on the first source range cell (the first cell to be replicated) and type /R. The prompt line displays `Replicate: Source range` to prompt you for a source range or for (END LINE).
2. The source coordinates (that is, the addresses of the cell or cells to be replicated) are now entered. To type in these source coordinates, first enter an ellipsis (pressing a single decimal point or period will generate the three-dot ellipsis) and then type in the last cell in the source range, followed by (END LINE), the colon (:), or (CONT). (Pressing (END LINE) or (CONT) also generates the colon in this command.) The final source range cell may be entered by "pointing the cursor," if desired.

   If the source range does not include the cell where the cell cursor is currently positioned, you can change the edit line with (BACK SPACE), then type in the correct source range first cell before entering the ellipsis (...) and the final cell of the source range.
3. The prompt line displays `Replicate: Target range` to ask you to enter the target coordinates (that is, the addresses of the cell or cells where the copies are to go). You may type in the target coordinates, or you may enter them by pointing the cell cursor. As with the source range, the target range cell coordinates must be separated by an ellipsis.
4. Press (END LINE).
5. If the expression to be replicated contains value references (that is, references to other cells), the prompt line displays `Replicate: No change, Relative` to ask you to select either N or R.

If the source range cell contents are to be simply repeated across the target range without modification, type N. However, if the value reference at each new cell position should always refer to the value reference in the same *relative* row or column position rather than to the original entry, your response is R.

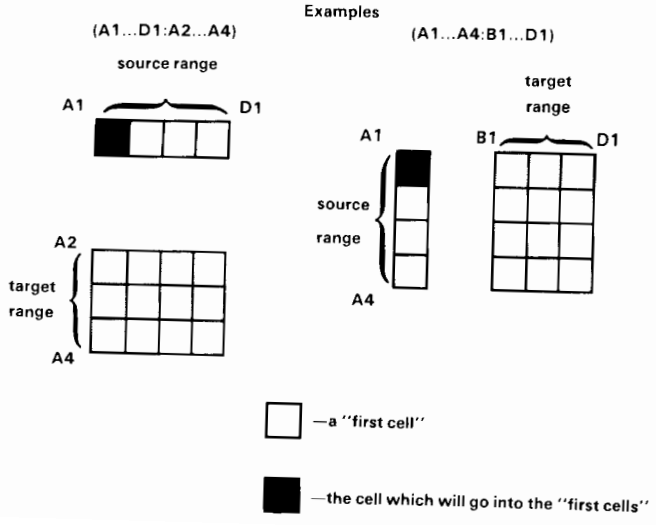
If there is more than one value reference in a cell to be replicated, VisiCalc prompts for No change or Relative for each value reference. When the prompt Replicate: No change, Relative appears on the prompt line, the edit line cursor appears at the first letter of the appropriate value reference.

To return to top-level mode from the replicate command *before* execution, press (SHIFT) (BACK SPACE).

When replicating a single cell into another single cell, your source and target ranges should both reference single cells (B2...B2:Q7...Q7). If you want to replicate a single cell into a row or column of cells, your source range is the single cell and your target range must refer to the first and last cells of the row or column (C1...C1:D2...G2, or A3...A3:D3...D8).

Replication of a row or column into another row or column is done by indicating the first and last cells of the source range and *just* the first cell of the target range (A6...D6:B7...B7, or F3...F8:E2...E2). Rows can only be replicated as rows, and the same applies to columns. A row cannot be replicated into a column, and a column cannot be replicated into a row.

You can also replicate a row or column into a range of adjacent rows or columns. For this procedure the source range is the first and last cells of the row or column to be replicated. If the structure being replicated is a row, then the target range should be the first and last cells of the *column consisting of all the "first cells"* (the cells which will receive a copy of the first entry of the source row). Otherwise, the target range should be the first and last cells of the *row consisting of all the "first cells"* (the cells which will receive a copy of the first entry of the source column).



Here are some examples of typical replications:

Replicating this source and target range:	Copies the contents of the cells as follows:
A1...A1:B1...G1	A1 into B1, C1, D1, E1, F1, G1
A1...A1:B1...B4	A1 into B1, B2, B3, B4
A1...A3:C1...C1	A1 into C1; A2 into C2; A3 into C3
A1...C1:A2...A2	A1 into A2; B1 into B2; C1 into C2
A1...C1:A2...A4	row A1...C1 into rows A2...C2, A3...C3, A4...C4
A1...A4:B1...D1	column A1...A4 into columns B1...B4, C1...C4, D1...D4

As with any other entry that appears on the edit line, you can correct or alter the replicate command by using (BACK SPACE).

If the cells in a source range or in a target range are not linear (i.e., not part of the same row or column), the cell replicated displays ERROR.

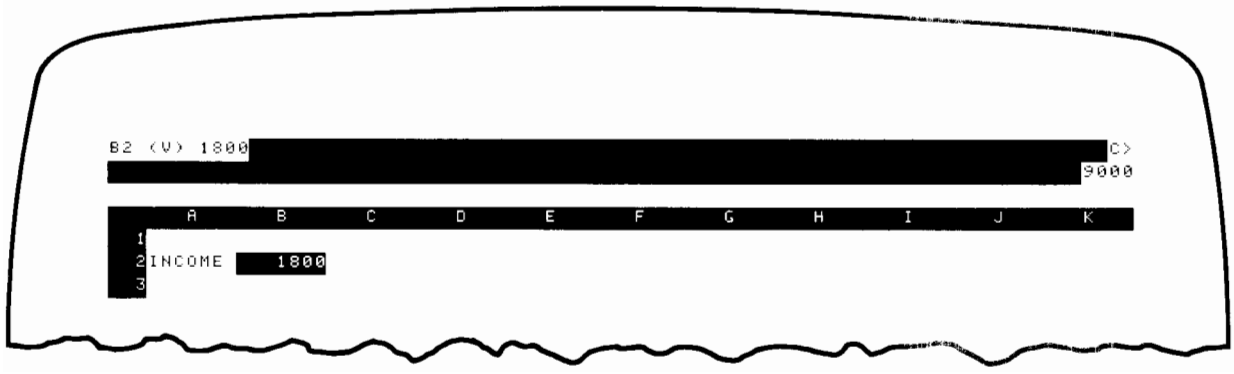
Replicating Numbers and Labels

With an expression, such as a simple label or number, that does not contain a value reference to another cell, the replicate command does not prompt for a No change or Relative replication. So all you need to do is press /R to select the replicate command, then type in the cell coordinates of the source and target ranges.

Example. Let's set up a simple monthly expense account for a full year. Our first entry will be *income,* which will be a constant $1800 per month for the year. To begin, we'll clear the VisiCalc worksheet and key in our first label, followed by one month's income:

Press /CY (>) A2 (END LINE) INCOME (→) 1800 (END LINE)

VisiCalc Display

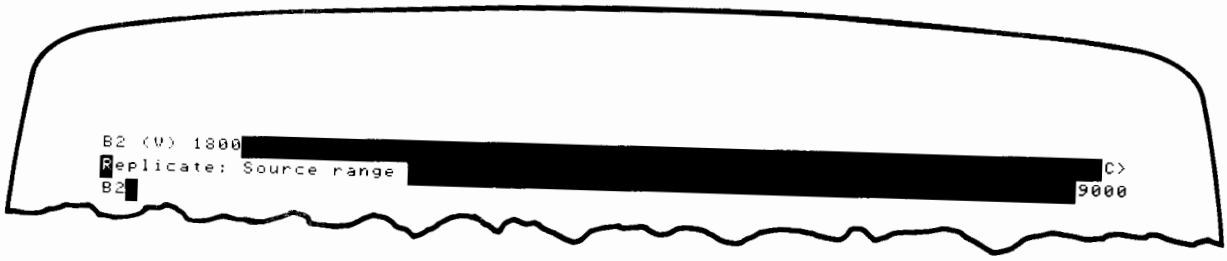


We now have the first month's income in cell B2. In order to create a row that includes income for each month of a 12-month period, we *could* move the cell cursor to C2 and type in 1800, then move it to D2 and do the same thing, all the way out through cell M2. But an easier way is to use the replicate command.

The value 1800 is our entire source for the replication. Since the cell cursor is already pointing to cell B2, which contains the number 1800, we can select the replicate command and proceed:

Press /R

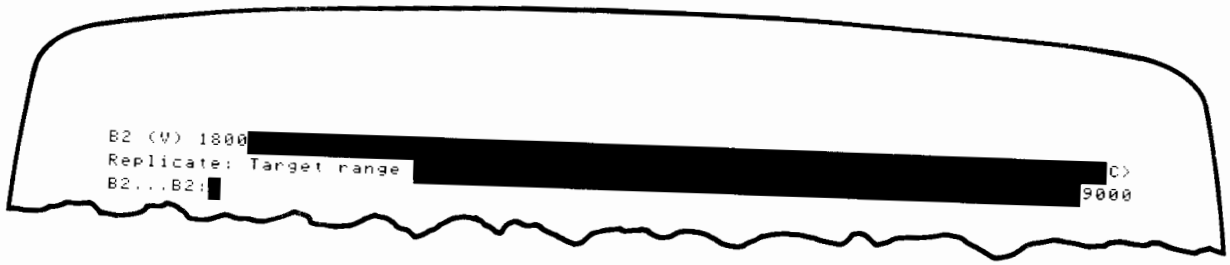
VisiCalc Status Area



As you can see, VisiCalc has prompted for the source range. Since our entire source for this replication will be cell B2, we press (END LINE), then select our target range. The target range will be the eleven cell positions from cell C2 to cell M2.

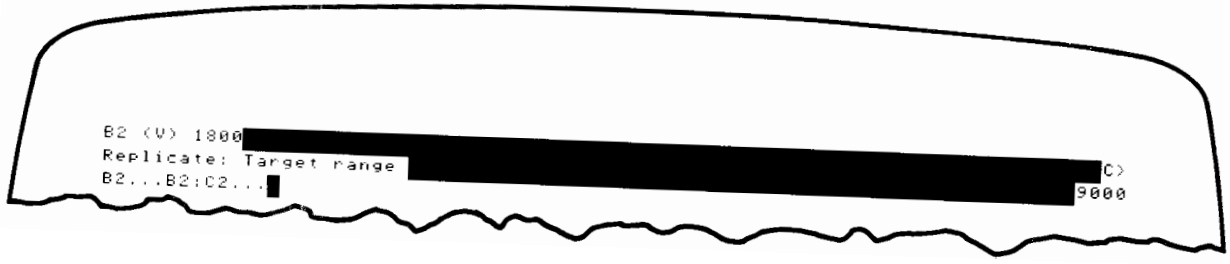
Press (END LINE)

VisiCalc Status Area



Press C2 (.)

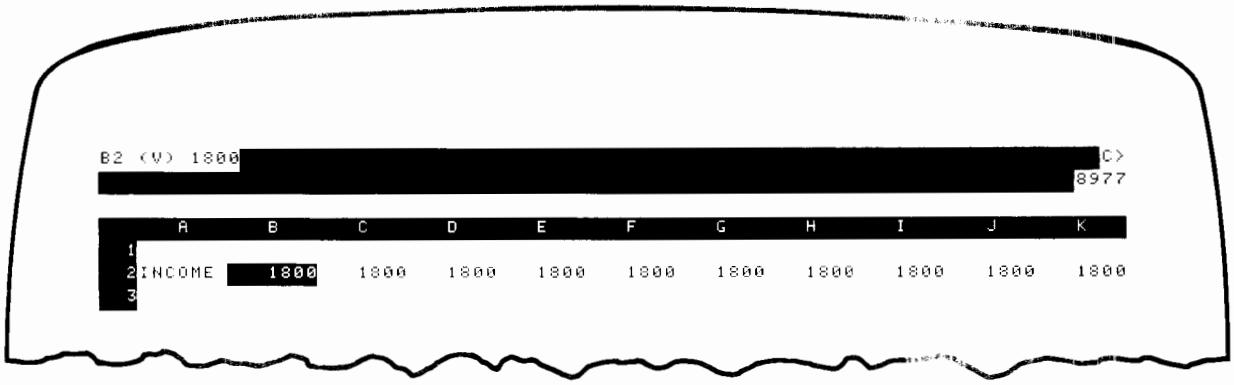
VisiCalc Status Area



Notice that when you keyed in the first cell of the target range, then pressed the decimal point key, an entire three-dot ellipsis was entered. To finish the replication, specify the ending coordinates:

Press M2 (END LINE)

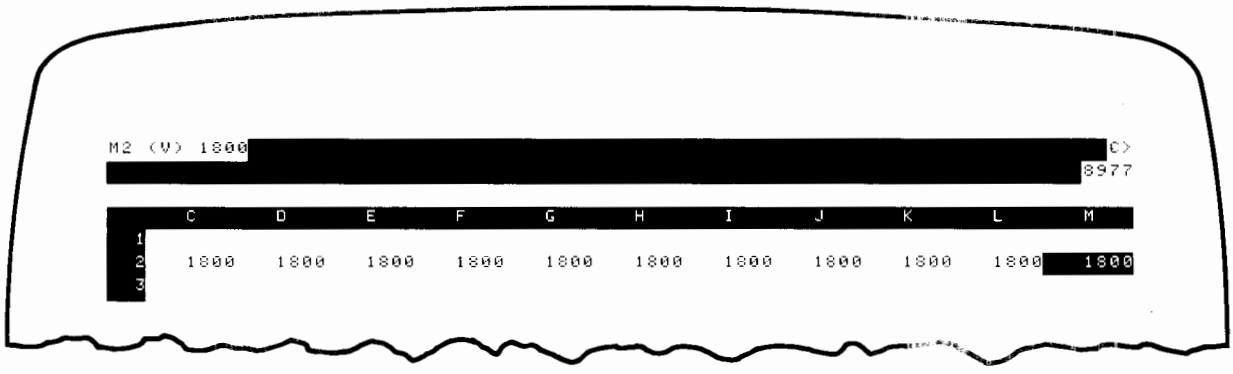
VisiCalc Display



To verify that the replication was performed through the entire target range you specified, you can scroll the window out to column M:

Press and Hold →

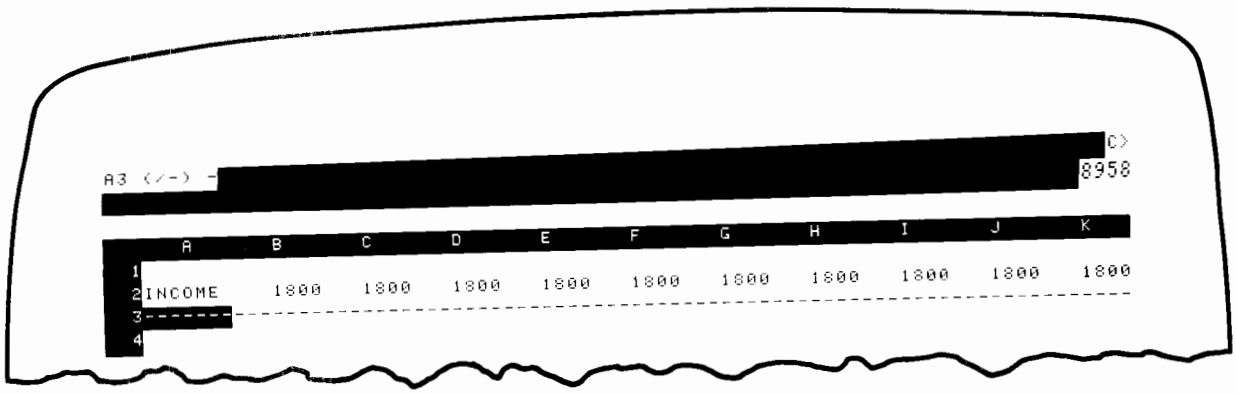
VisiCalc Display



The replicate command also copies labels. For example, to type a line across the worksheet below your entries for *income*:

Press (>) A3 (END LINE) /--- (END LINE) /R (END LINE) B3 (.) M3 (END LINE)

VisiCalc Display



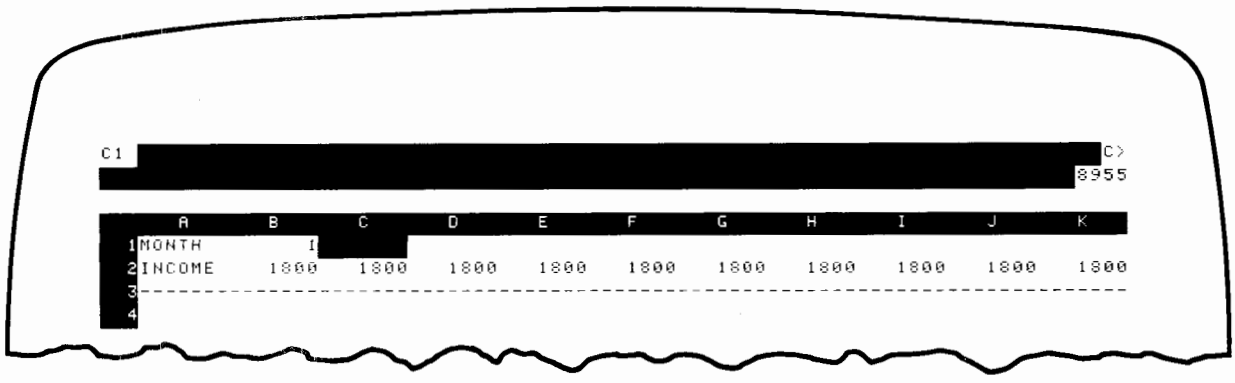
Replicating a Formula

When you replicate a formula that contains a value reference, you must decide whether you want the formula replicated exactly as written, with *no change*, or whether you want the formula that is replicated into each succeeding cell to be changed so that it is *relative* to the preceding cell.

Example. To help label the monthly expense account that we began setting up in the previous example, we'll place a title for months on the first line and follow it with the numbers 1, 2, 3, etc., over the columns from B through M:

Press (↖) MONTH (→) 1 (→)

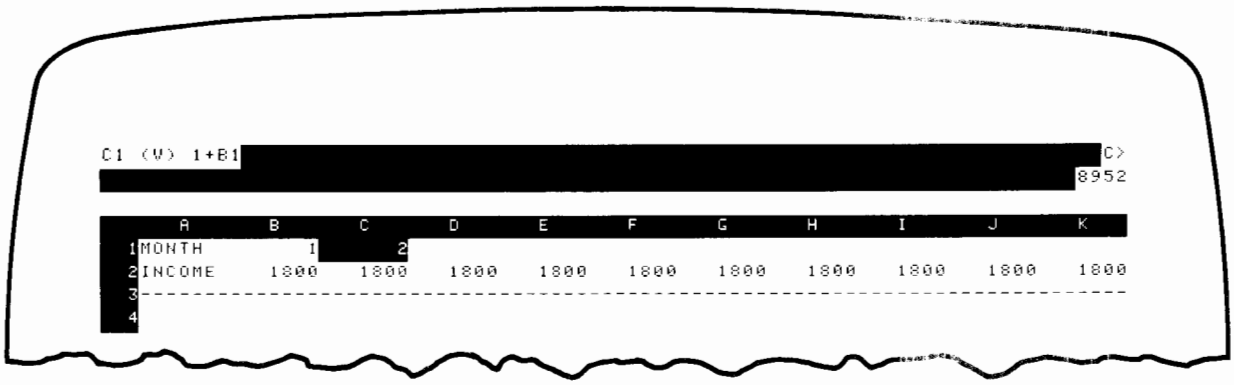
VisiCalc Display



At this point, we could type 2 in column C, and so forth. But instead let's use a formula to calculate the number for the next column. Clearly, if the value in cell C1 is calculated using the formula 1 + B1, it will be the desired number 2:

Press 1 + B1 (END LINE)

VisiCalc Display



Now we'll replicate the formula out to cell M1. If we simply replicated the formula with no change, the formula 1 + B1 would be repeated in each cell of our target range. But since we want the formula in cell D1 to be relative to the formula in C1 (to refer to the cell immediately preceding it, just like the formula in C1 does), and E1 relative to D1, etc., we'll specify relative replication:

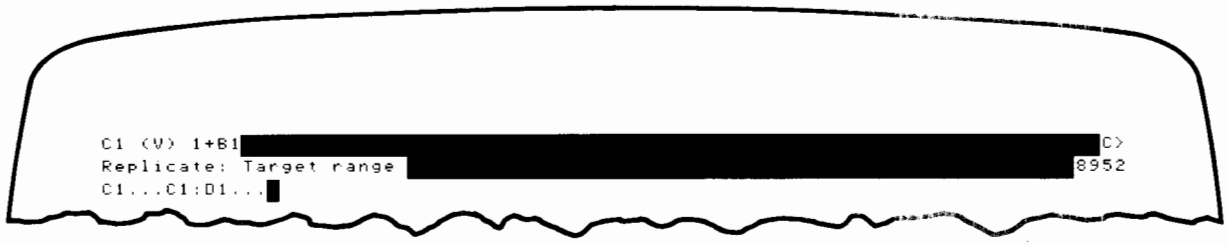
Press /R (END LINE)

VisiCalc Status Area

Our source range is cell C1 only. For our target range, if desired we can "point the cursor" instead of typing in the cell coordinates. Just point the cell cursor to select D1 followed by an ellipsis, then move the cell cursor to position M1 and press (END LINE):

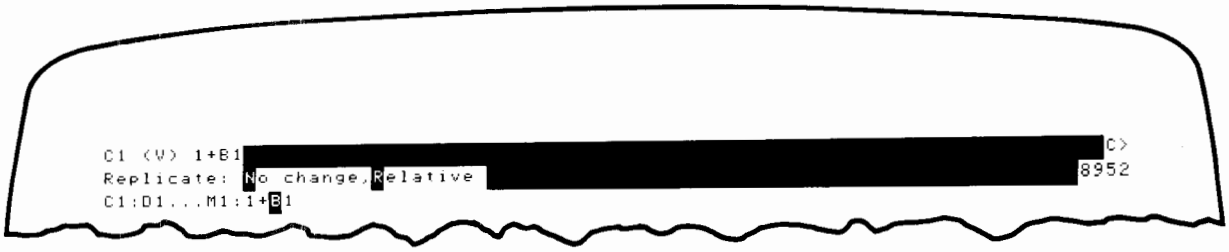
Press (→)(.)

VisiCalc Status Area



Press and Hold → END LINE

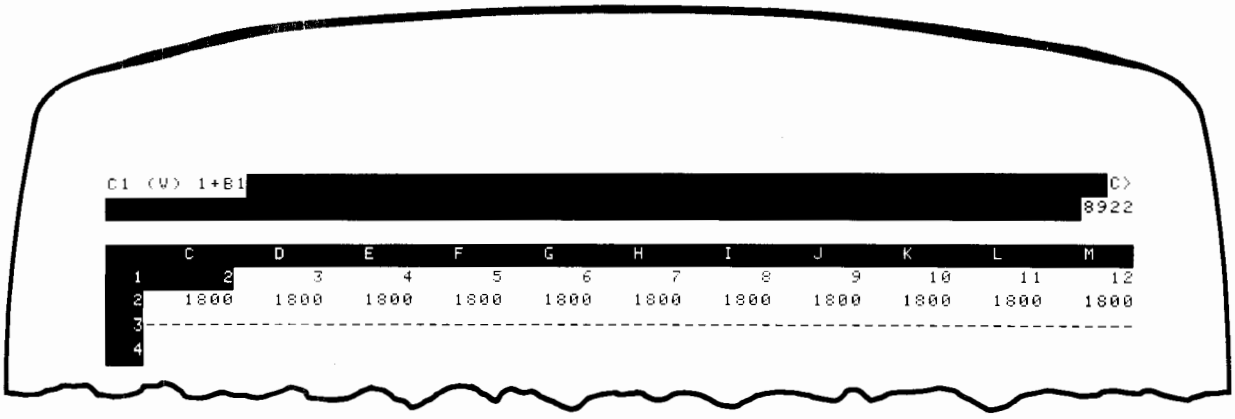
VisiCalc Status Area



VisiCalc is prompting you for the type of replication: N for *no change* or R for *relative*. Since we want the replication to be relative:

Press R

VisiCalc Display

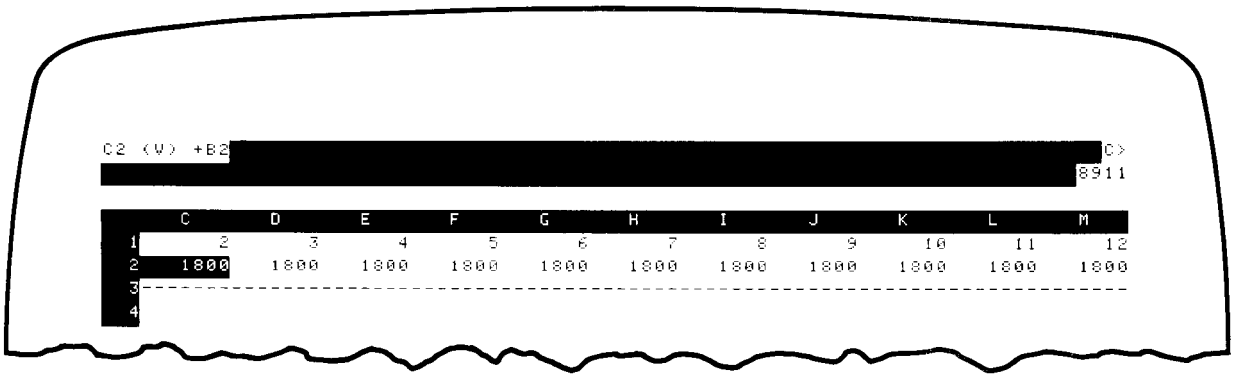


As you can see, the replication was a relative one, with the formula not merely *copied* in each cell, but actually depending on the formula in the previously replicated cell for its argument.

Now think for a minute about our example. If your income in the sixth month changed to $2000, you'd have to change it in that month and in each following month. Instead, let's use a relative replication of a formula to make the calculated value for each month's income depend on that of the month before it:

Press (>) C2 (END LINE) + B2 (END LINE) /R (END LINE) D2 (.) M2 (END LINE) R

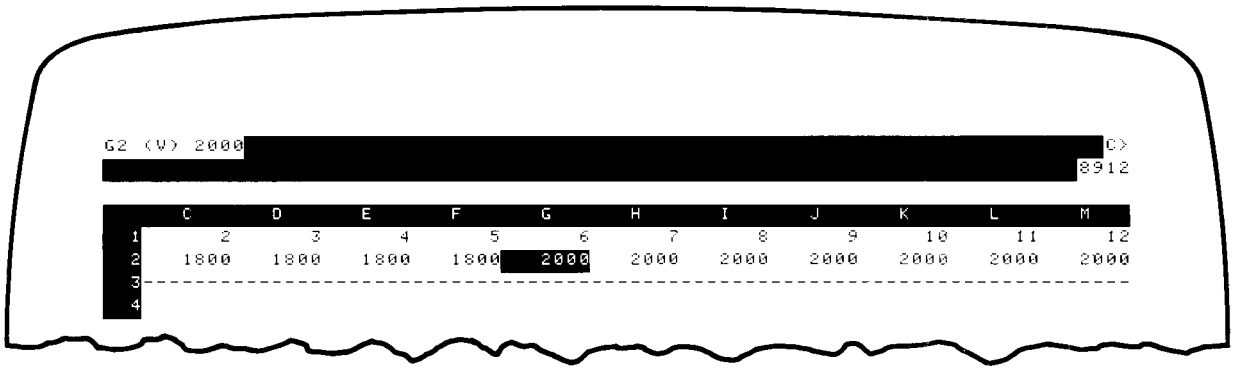
VisiCalc Display



Now if in the sixth month you received a raise in salary to $2000, you could account for it there and in every following month just by changing the value in the sixth month. To try it:

Press (>) G2 (END LINE) 2000 (END LINE)

VisiCalc Display



If you scroll out to cell M2, you'll see that the incomes for all following months have also been changed to $2000.

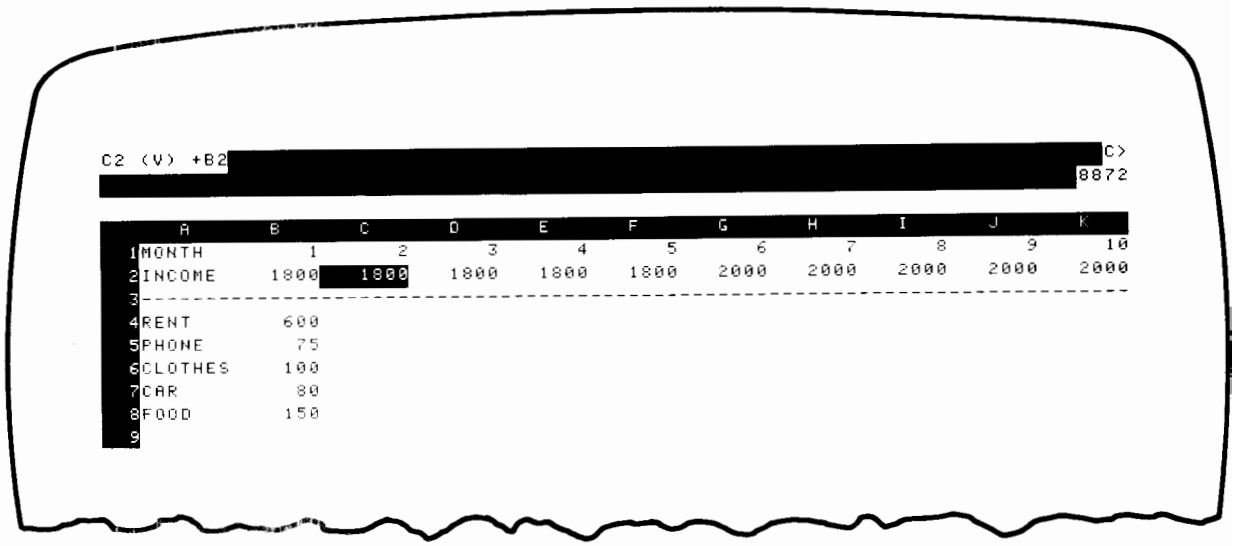
Replicating Down Columns

Replicating down a column is similar to the replications you have seen thus far. You simply set the cell cursor to the first cell whose contents are to be replicated, and press /R. Then press (END LINE), or enter an ellipsis (...) followed by the cell coordinates of the end of the source range, followed by (END LINE). Finally, select the target range—that is, the cells into which the contents of the source range are to be repeated—separated by an ellipsis. If an expression in the source range is a formula with a value reference, you'll also have to specify whether the formula is to be repeated with no change or relative to other formulas.

There are three versions of columnwise replication. You can replicate a single cell down a column. You can replicate an entire column into another one. You can also replicate a column across a range of adjacent columns.

Example. To continue the example we began earlier, let's add some more entries to our monthly expense account. Type in the labels and values so your worksheet looks like the one shown here:

VisiCalc Worksheet



Next, we would like to replicate the monthly expense figures in column B (month #1) across for the remaining 11 months. Remember our discussion of the merits of replicating a number versus a formula for our monthly income? To give ourselves maximum flexibility, we should also replicate formulas for the monthly expenses. At C4 we want the formula + B4; at C6 we want the formula + B6; at C7 we want + B7; and so on. These formulas are so similar to each other and to the income formula + B2 that it's tempting to look for a shortcut in typing them. Once again, the replicate command comes to our aid. This time, we'll replicate a formula down a column instead of across a row.

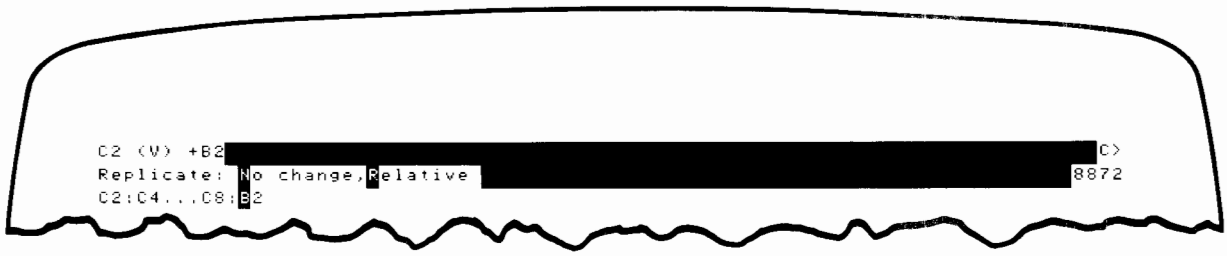
First, make sure that the cursor is at C2, so the entry contents line reads C2 (V) + B2. Then replicate that formula from C4 to C8:

Press (>) C2 (END LINE) /R (END LINE) C4 (.) C8

VisiCalc Status Area

Press (END LINE)

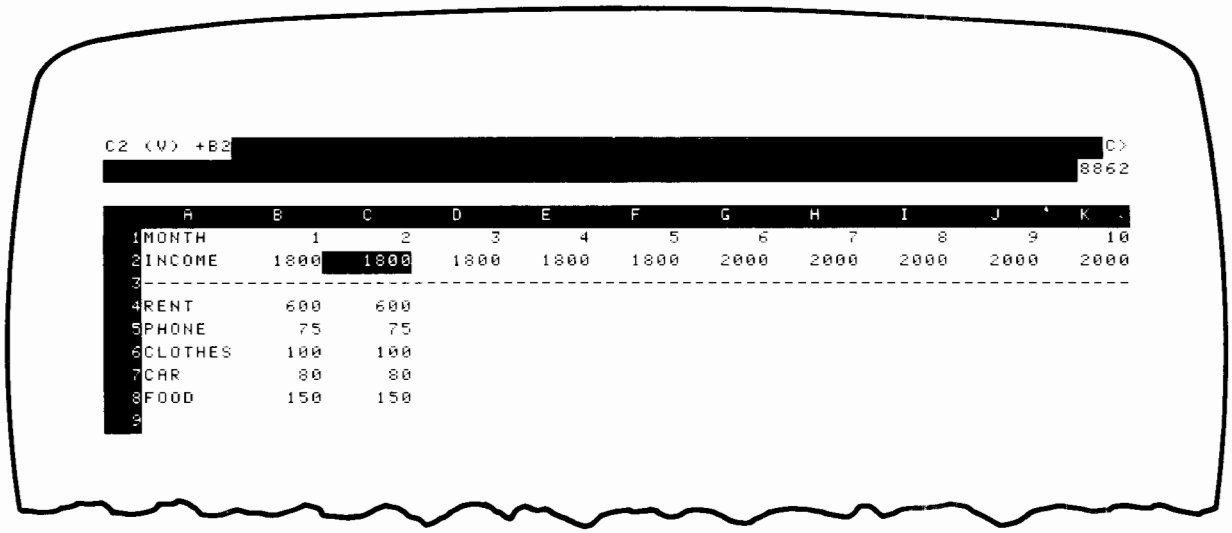
VisiCalc Status Area



In a relative sense, C2 is to B2 as C4 is to B4, and so on. We want to treat the coordinate C2 as *relative* to B2, and the other formulas we're replicating as relative to the other numbers in column B. So:

Press R

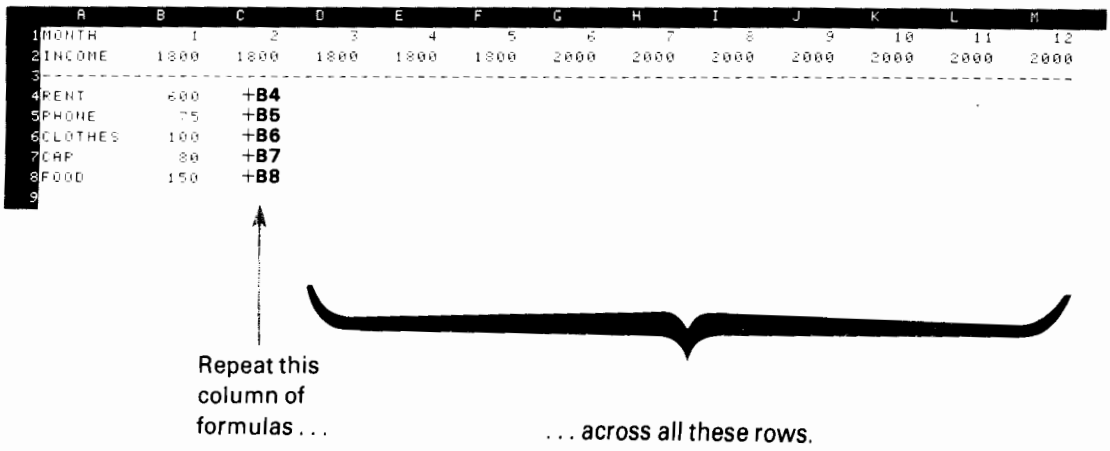
VisiCalc Display



A column of numbers, from 600 to 150, has appeared in column C. Use the ↓ key to move the cursor downward, pausing to look at the formulas we've replicated. We have what we wanted: at C4 is + B4, at C6 is + B6, and so on.

In order to replicate a column of expressions across several rows, simply specify the top and bottom cells of the column as source coordinates, and the top cells of the first and last columns into which the column is to be repeated as the target coordinates.

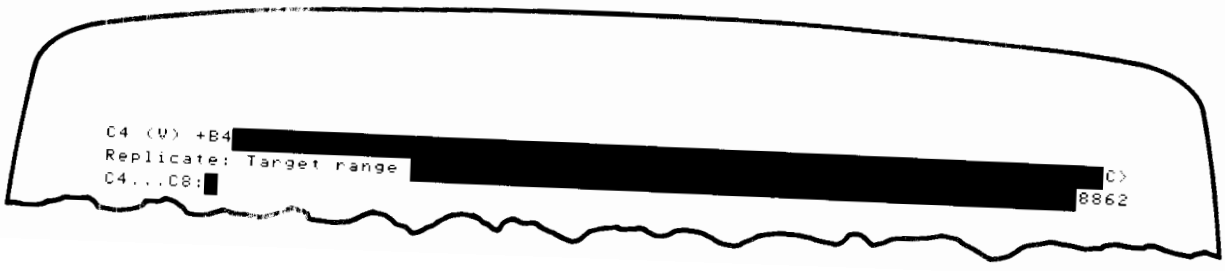
Example. In the expense account worksheet we have been writing on in this section, we will want to repeat the entire *column* of formulas across the *rows* for each month.



To perform the replication, first specify the top and bottom cells of the column as the source range coordinates:

Press > C4 END LINE /R . C8 END LINE

VisiCalc Status Area



Now specify as the target range the first cells of the left-most and right-most columns into which you want the column replicated:

Press D4 . M4 END LINE

VisiCalc Status Area

Naturally, the replication should be relative, in order to maintain the relationship of all formulas to their preceding expressions:

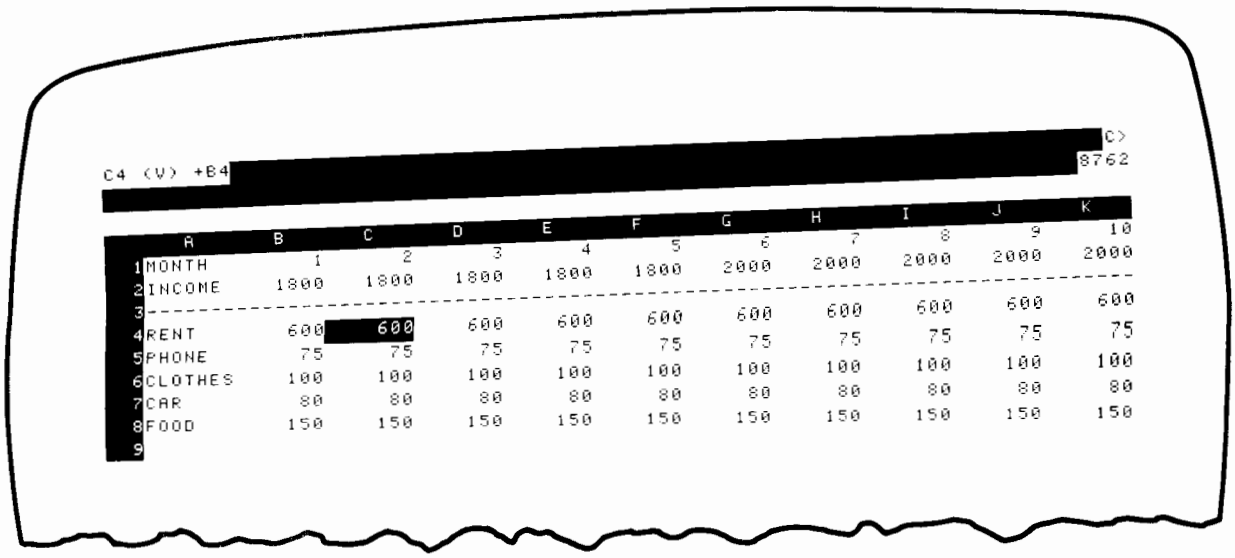
Press R

VisiCalc Display

Look at the edit line. It reads C5:D5...M5. VisiCalc has finished replicating the formulas B4, C4, D4, etc., in row 4, and now wants to know how to handle the formula B5 on row 5. Just press R four more times and watch as the rest of the column is replicated:

Press RRRR

VisiCalc Display

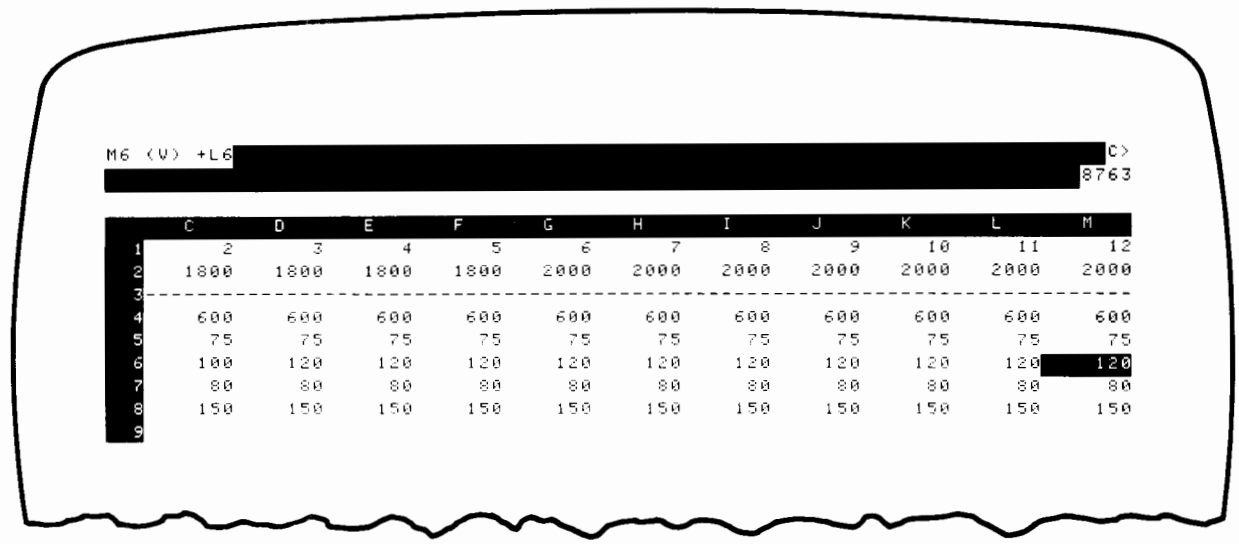


	A	B	C	D	E	F	G	H	I	J	K
1	MONTH	1	2	3	4	5	6	7	8	9	10
2	INCOME	1800	1800	1800	1800	1800	2000	2000	2000	2000	2000
3											
4	RENT	600	600	600	600	600	600	600	600	600	600
5	PHONE	75	75	75	75	75	75	75	75	75	75
6	CLOTHES	100	100	100	100	100	100	100	100	100	100
7	CAR	80	80	80	80	80	80	80	80	80	80
8	FOOD	150	150	150	150	150	150	150	150	150	150
9											

Think about the technique we used to replicate the expense formulas. Starting with the prototype formula +B2 at position C2, we created six more prototype formulas by replicating down a column: +B4 at C4, +B6 at C6, etc. Then, we used these formulas as our source range to replicate similar formulas across rows 4 through 8. Each of the resulting monthly expenses can be changed for all twelve months simply by typing a new number for the first month. For example, to raise your budget for *clothes* to $120 for the last ten months of the year:

Press (>) D6 (END LINE) 120 (END LINE) (>) M6 (END LINE)

VisiCalc Display



	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12
2	1800	1800	1800	1800	2000	2000	2000	2000	2000	2000	2000
3											
4	600	600	600	600	600	600	600	600	600	600	600
5	75	75	75	75	75	75	75	75	75	75	75
6	100	120	120	120	120	120	120	120	120	120	120
7	80	80	80	80	80	80	80	80	80	80	80
8	150	150	150	150	150	150	150	150	150	150	150
9											

You can see that your budget for clothes on row 6 has been changed for the remainder of the year. Note that the formula in cell D6 now is independent of the formula in any other cell.

Replicating Across Rows

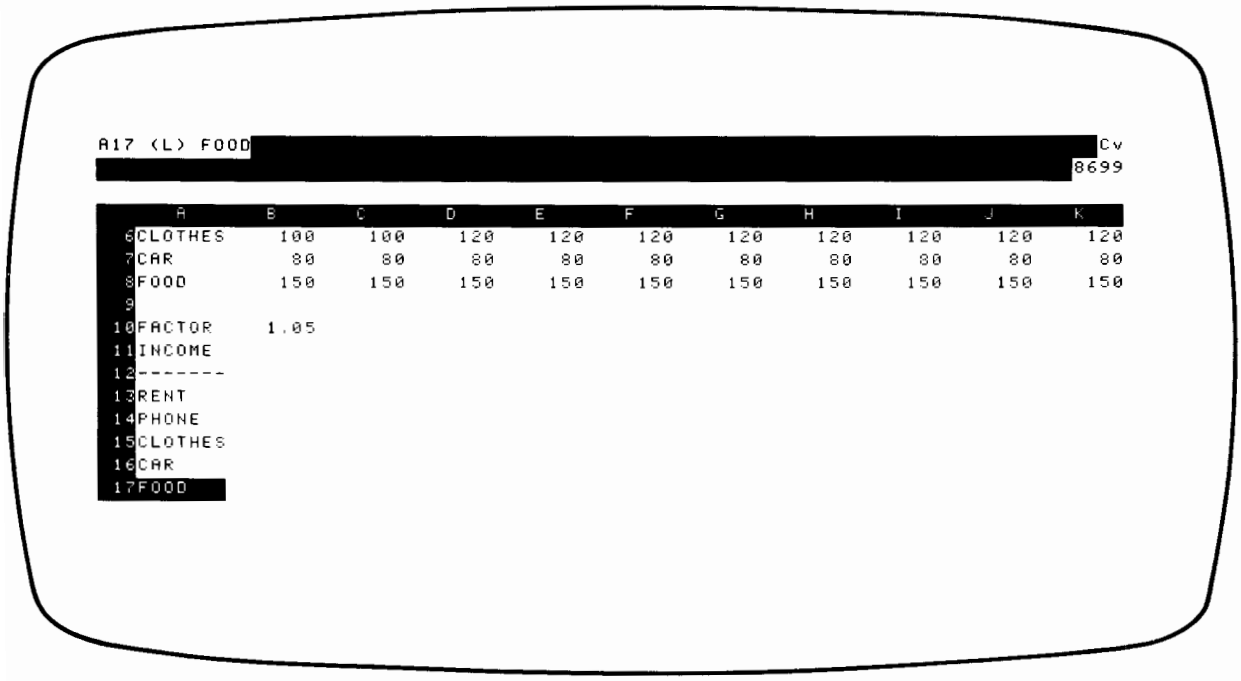
The replication of a formula or expression across a row, or the replication of a row across a range of rows can be done using the same methods applied to columns. Let's use this technique to play "what if" with expenses in our example.

Example. Assuming that expenses are proportional to income, we would like to know what the expenses would be if income was multiplied by some constant. Multiplying income by 1.05 represents getting a 5% raise. What would expenses be then? We should be able to find out by multiplying all expenses by the same factor, 1.05. Let's set up another table and find out.

First, we set up the labels:

Press (>) A10 (END LINE) FACTOR (→) 1.05 (END LINE) (>) A11 (END LINE) INCOME (↓) /-- (CONT)
RENT (CONT) PHONE (CONT) CLOTHES (CONT) CAR (CONT) FOOD (END LINE)

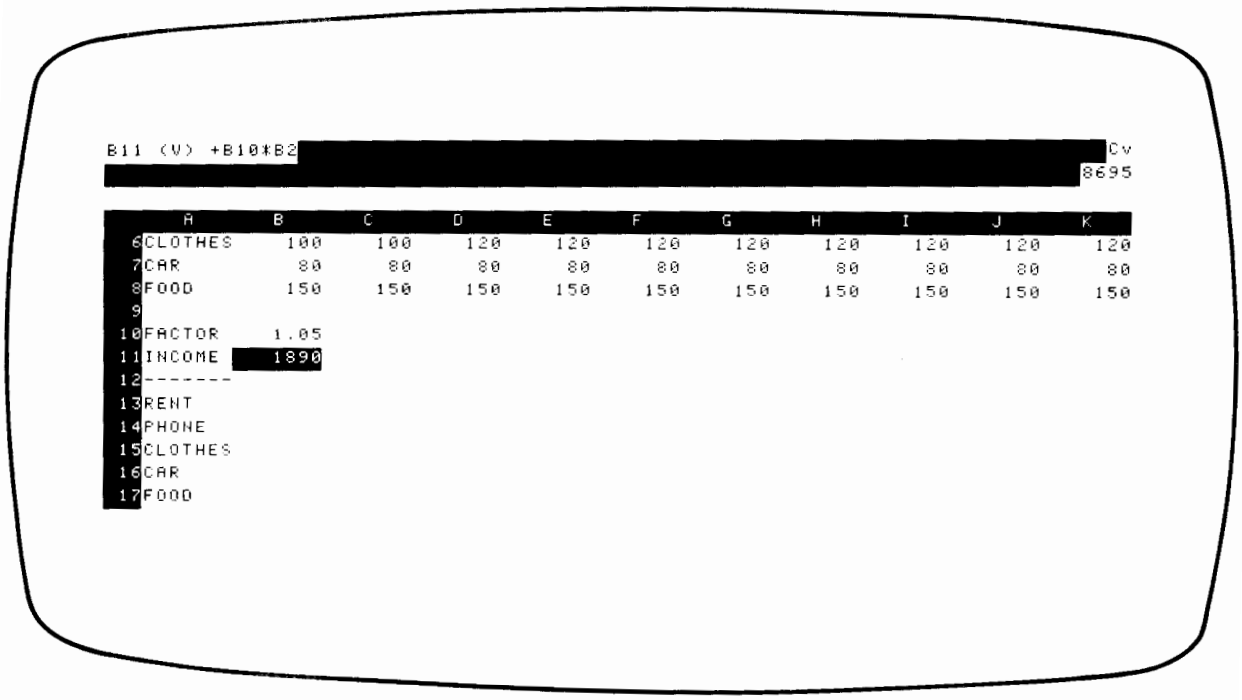
VisiCalc Display



Next, we see what income would look like if we had started with a 5% raise in the first month:

Press (>) B11 (END LINE) + B10 * B2 (END LINE)

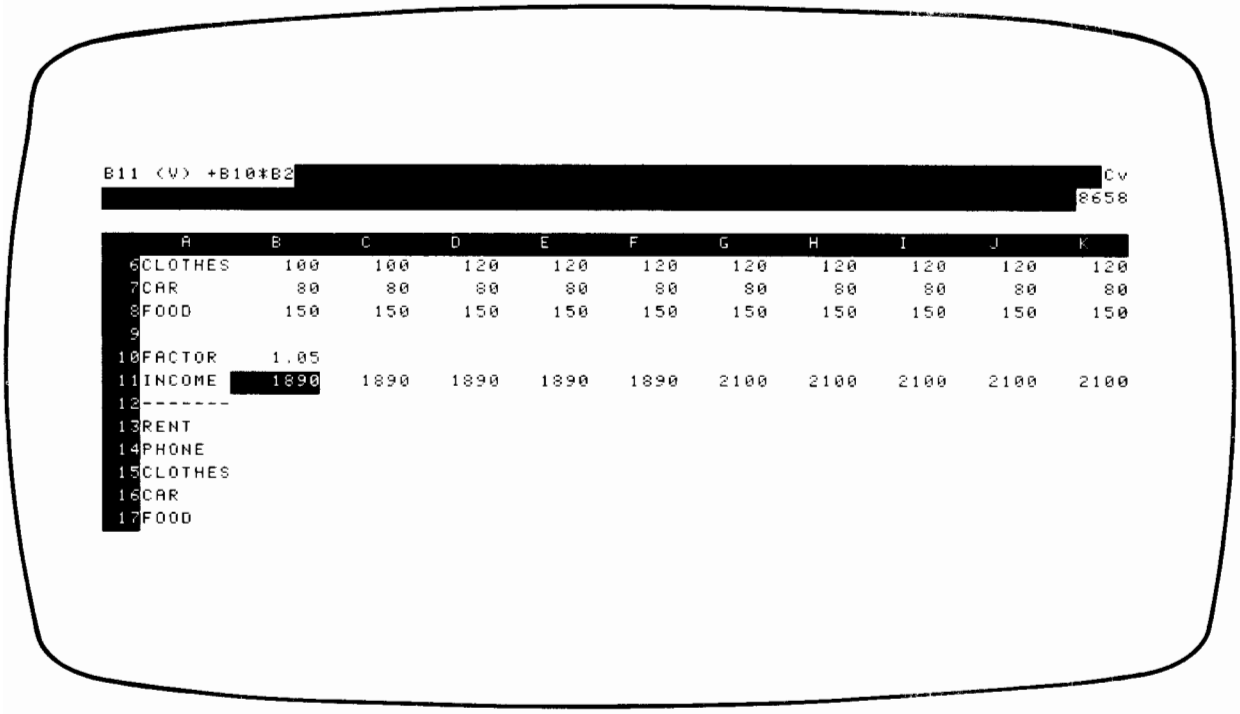
VisiCalc Display



Now, let's extend this formula to the remaining months, using the *same* constant but a *relative* income factor:

Press /R (END LINE) C11 (.) M11 (END LINE) N R

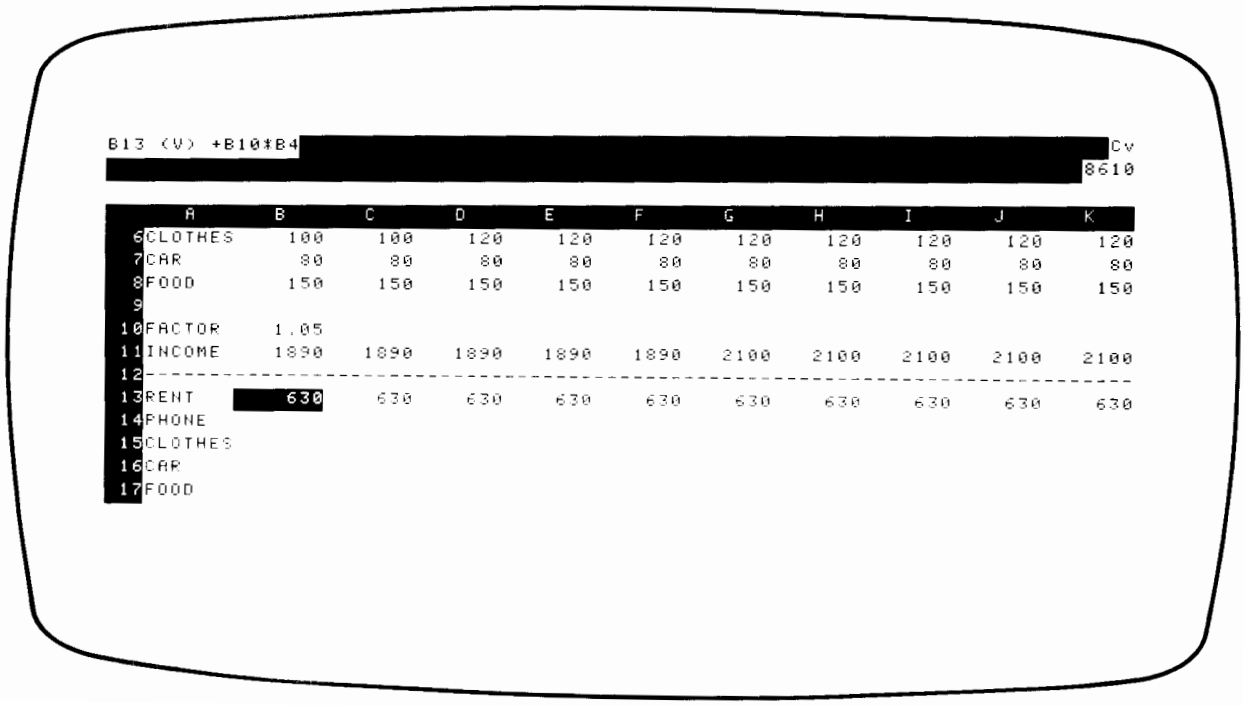
VisiCalc Display



We're ready to calculate the expenses now. We will use the same formula, with the same constant but a relative expense factor:

Press (>) A12 (END LINE) /R (END LINE) B12 (.) M12 (END LINE) (>) B13 (END LINE) + B10 * B4 (END LINE) /R (END LINE) C13 (.) M13 (END LINE) N R

VisiCalc Display



Finally, we will extend this row to the ones below it, so that they will show the new expenses:

Press /R (.) M13 (END LINE) B14 (.) B17 (END LINE) N R N R N R N R N R N R N R N R N R N R N R N R

VisiCalc Display

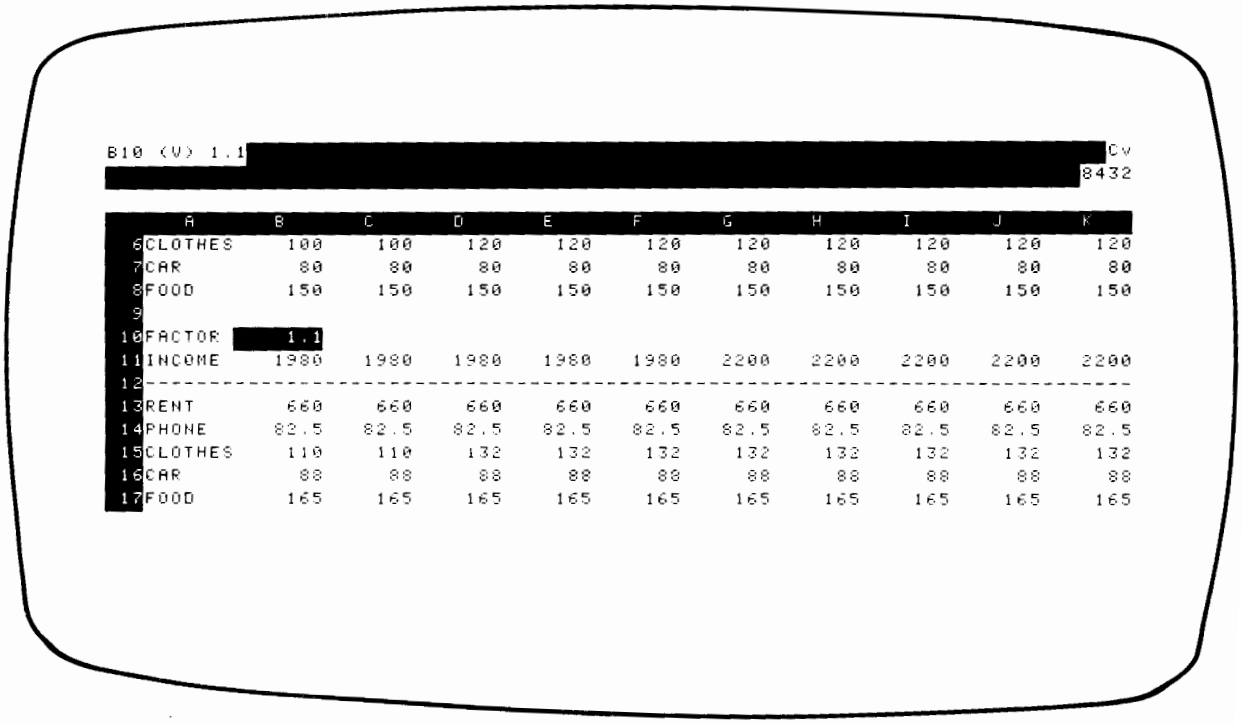
```
B13 (V) +B10*B4                                        Cv
                                                     8430
```

	A	B	C	D	E	F	G	H	I	J	K
6	CLOTHES	100	100	120	120	120	120	120	120	120	120
7	CAR	80	80	80	80	80	80	80	80	80	80
8	FOOD	150	150	150	150	150	150	150	150	150	150
9											
10	FACTOR	1.05									
11	INCOME	1890	1890	1890	1890	1890	2100	2100	2100	2100	2100
12	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
13	RENT	630	630	630	630	630	630	630	630	630	630
14	PHONE	78.75	78.75	78.75	78.75	78.75	78.75	78.75	78.75	78.75	78.75
15	CLOTHES	105	105	126	126	126	126	126	126	126	126
16	CAR	84	84	84	84	84	84	84	84	84	84
17	FOOD	157.5	157.5	157.5	157.5	157.5	157.5	157.5	157.5	157.5	157.5

What if our initial raise was 10% instead of 5%?

Press (>) B10 (END LINE) 1.10 (END LINE)

VisiCalc Display

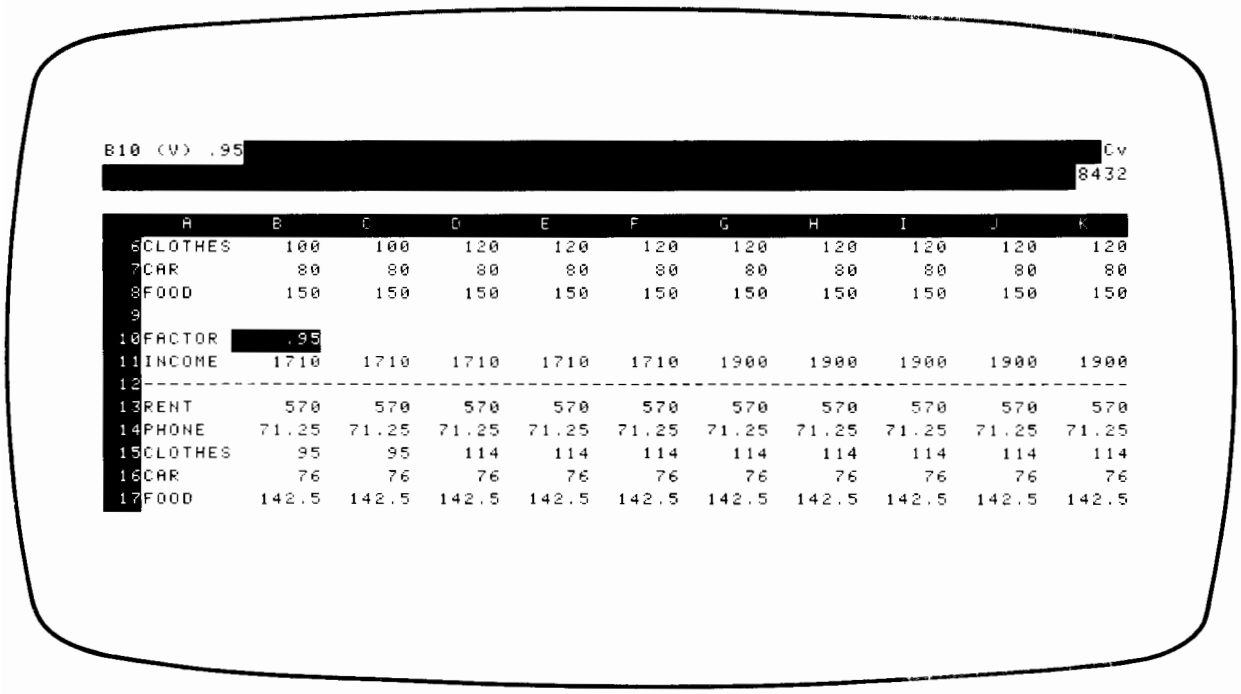


	A	B	C	D	E	F	G	H	I	J	K
6	CLOTHES	100	100	120	120	120	120	120	120	120	120
7	CAR	80	80	80	80	80	80	80	80	80	80
8	FOOD	150	150	150	150	150	150	150	150	150	150
9											
10	FACTOR	1.1									
11	INCOME	1980	1980	1980	1980	1980	2200	2200	2200	2200	2200
12	---	---	---	---	---	---	---	---	---	---	---
13	RENT	660	660	660	660	660	660	660	660	660	660
14	PHONE	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5	82.5
15	CLOTHES	110	110	132	132	132	132	132	132	132	132
16	CAR	88	88	88	88	88	88	88	88	88	88
17	FOOD	165	165	165	165	165	165	165	165	165	165

What if we had been docked 5% in the first month?

Press .95 (END LINE)

VisiCalc Display



B10 (V) .95 Cv

8432

	A	B	C	D	E	F	G	H	I	J	K
6	CLOTHES	100	100	120	120	120	120	120	120	120	120
7	CAR	80	80	80	80	80	80	80	80	80	80
8	FOOD	150	150	150	150	150	150	150	150	150	150
9											
10	FACTOR	.95									
11	INCOME	1710	1710	1710	1710	1710	1900	1900	1900	1900	1900
12											
13	RENT	570	570	570	570	570	570	570	570	570	570
14	PHONE	71.25	71.25	71.25	71.25	71.25	71.25	71.25	71.25	71.25	71.25
15	CLOTHES	95	95	114	114	114	114	114	114	114	114
16	CAR	76	76	76	76	76	76	76	76	76	76
17	FOOD	142.5	142.5	142.5	142.5	142.5	142.5	142.5	142.5	142.5	142.5

The replicate command is one of the most powerful and useful in the entire set of VisiCalc instructions. As you practice and become more familiar with it, you will find that it can save you literally hours you would otherwise spend typing in values and labels.

Section 6

Formatting the Worksheet

This section explains how to alter the appearance of cell contents. It explains how to use the /F, *local format,* command, to change the format (that is, the way the contents appear) of a single cell, and it tells you how to use the /G, *global,* command to alter the format of the entire worksheet at once. This section also illustrates scientific notation and overflow displays.

Remember, formatting, whether done globally or locally, alters only the *appearance* of the numbers and labels on the VisiCalc worksheet. Internally, each cell can hold a label of up to 158 characters, and each cell always computes with values that are maintained to a precision of 12 significant digits.

Local Formatting

When you first load the VisiCalc program, or when you clear the worksheet with the /CY command, all cells in VisiCalc default to the *general* format. In the general format, labels are left-justified (beginning at the left-hand side of the cell). Numbers are displayed in whatever form will show the most information about each entry.

You can alter the format of a selected cell by specifying the /F (*local format*) command.

To change the format of a selected cell:

1. Set the cell cursor to the desired cell.
2. Type in the command /F. The prompt line shows Format: D G I L R $ *.
3. Select the desired local format by typing the letter for that format. The format is executed immediately, and the appearance of the number or label is changed to the new local format.

Unless you change the local format specifically, or clear VisiCalc back to its initial state by reloading the program or typing /CY, the local format is maintained in spite of all *global* format commands. (That is, local formatting overrides any global formatting.)

Available Formats

Here are the specific formats abbreviated in the prompt Format: D G I L R $ *:

/FD Resets a cell entry to use the *global default format* (that is, whatever *global* format to which the rest of the worksheet has been set) instead of any local format previously set with the /F command.

/FG *Local general format.* Values are right-justified with as many digits displayed as possible, leaving a blank left-hand column. Labels are left-justified beginning with the left-hand column. This lets you select the same format for a cell that was set when the VisiCalc program was loaded, regardless of the global format over the rest of the worksheet.

/FI *Local integer format.* Values are right-justified without a decimal point, with a blank left-hand column. Values are rounded, not truncated. Labels are left-justified.

/FL *Local left-justified format.* Values are left-justified with a blank left-hand column. Labels are left-justified.

/FR *Local right-justified format.* Values and labels are right-justified.

/F$ *Local dollars and cents format.* Values have a blank left-hand column and are rounded to two decimal plaes.

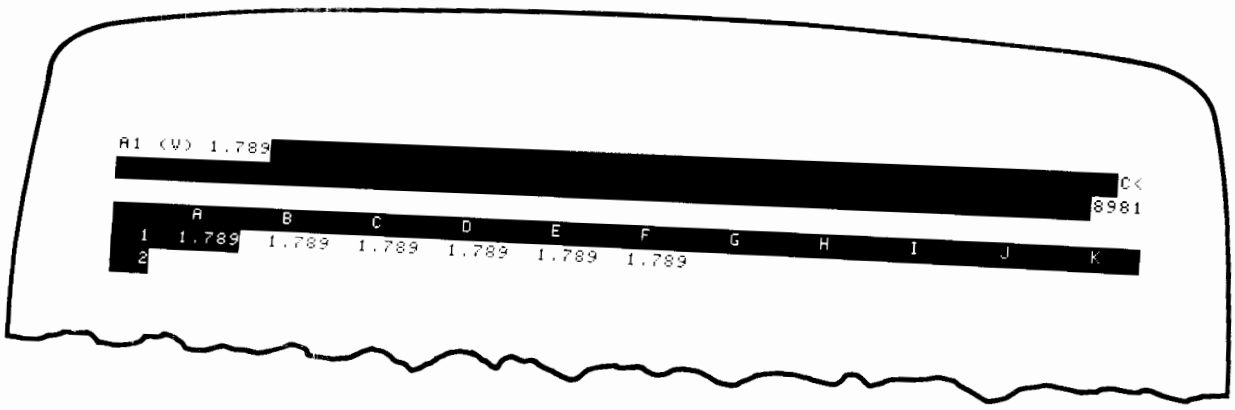
/F* *Local grpahing format.* Converts cell values to asterisks. For example, a value of 5 (or −5) returns five asterisks (*****). Fractional values are rounded, not truncated. Labels are left-justified.

The type of local format appears in the entry contents line.

Example. Let's examine the number 1.789 in several formats:

Press /CY 1.789 END LINE /R END LINE B1 . F1 END LINE

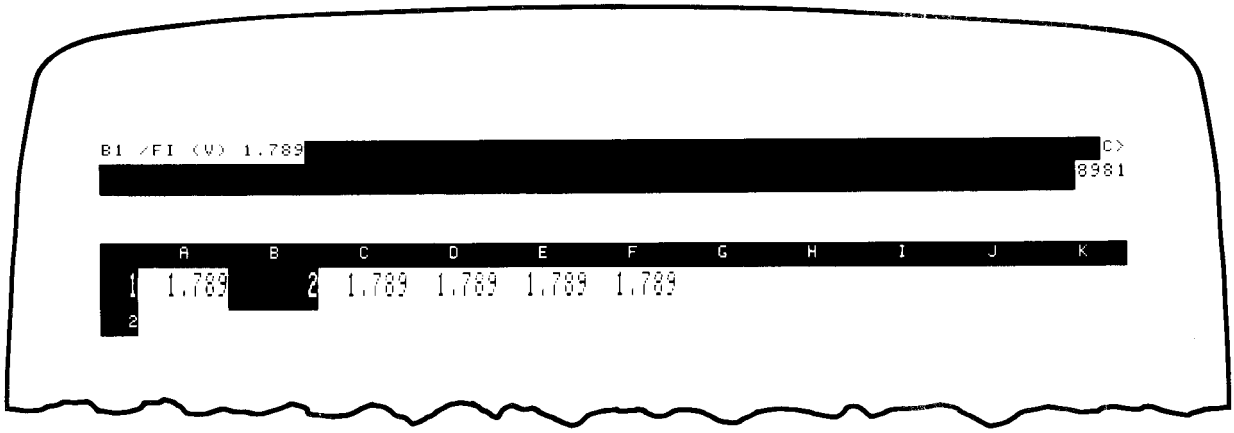
VisiCalc Display



We now have the same number, 1.789, replicated in six positions in row 1. Now we'll change the formats of these numbers, beginning with the contents of B1:

Press →/FI

VisiCalc Display



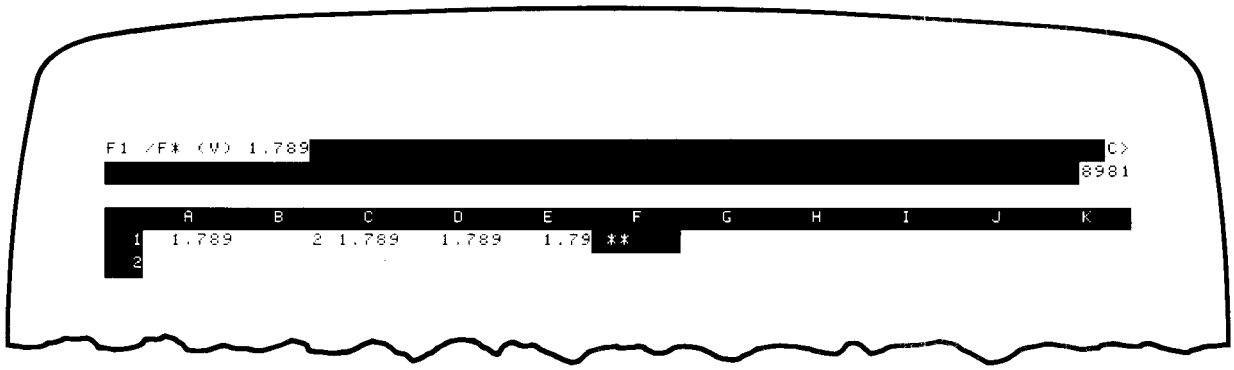
As you can see, the appearance of the number in cell B1 has been changed to *integer* format. The number is rounded, with none of its decimal places visible in the cell. Naturally, it maintains its full value internally, and you can see this value by examining the entry contents line at the top of the VisiCalc status area.

In addition to the cell coordinates and the full value in the cell, the entry contents line also contains an indicator, /FI, of the local format of the cell.

Let's try some different formats on the other numbers:

Press →/FL→/FR→/F$→/F*

VisiCalc Display



The number in cell C1 is in *left-justified format,* the number in D1 is *right-justified,* and the number in E1 is in *dollars and cents format,* with two decimal places visible. The number in F1 is shown in the *local graphing format,* with asterisks indicating the magnitude of the value.

Local formatting always takes precedence over a global format. The only way to change or clear a local format is with the /F command, the /C (*clear*) command, or by reloading the VisiCalc program.

Replicating a Local Format

Just as you can replicate the label, value, or formula in a cell down columns or across rows, you can also replicate the format. In fact, whenever you replicate a cell, if a local format has been specified in that cell, the local format is replicated as well. Each new cell appears in that specific local format.

To replicate *only* a local format, just specify the format with the /F command, then fill the cell with a blank by using the /B command. (If the cell is already blank, just use the /F command to select its format.) Then replicate the cell over the desired range with the /R command. All cells replicated in the range will contain blanks and will be in the selected format, ready for data.

Global Formatting

The /G, or *global,* command permits you to change the width of the columns that you see on the worksheet, to change the format over the entire sheet, to alter the worksheet's background color and page size, and to select recalculation options. (Unlike the formatting commands, recalculation *can* alter the actual contents of the cells. We discussed recalculation in section 4.)

When you select the global command by pressing /G, the prompt line displays **G**lobal: C O R F P B. The global commands available are:

/GC The prompt line displays Column width. Sets the column width to any width from 3 to 77 characters. Requires (END LINE) to execute. If two windows are present, column width may be individually specified for each window. (Splitting the window is discussed in section 7.) Default column width is seven characters.

/GF The prompt line displays **F**ormat: D G I L R $ *. Sets the global default format, which determines the display format of all cell entries having no local display format set with a /F command. The commands perform the same function in global mode as in local mode. /GFG, *global default format,* sets the global default format to the general format, just like when VisiCalc is first loaded or /CY is executed.

/GP *Global page size.* Your personal computer can display either 12 or 20 rows of the VisiCalc worksheet. If /GP is executed while 12 rows are displayed, 20 will then be shown. If you see 20 rows and you press /GP, you will then see 12 rows. This command is executed immediately after you press the P.

/GB *Global background.* This command takes advantage of the inverse video capability of your Series 80 Personal Computer. If the worksheet has a black background when /GB is pressed, it will be changed to a white background. If you see a white background when /GB is executed, you will then see a black background. This command is executed immediately after you press the B.

/GO The prompt line displays **R**eevaluate order: **R**ow **C**olumn.

/GR The prompt line displays **R**ecalculate: **A**uto **M**anual.

Refer to section 4 for a discussion of the recalculation commands /GO and /GR.

Changing Column Width

The /GC (*global column width*) command permits you to change the column width of the VisiCalc worksheet so that the cells are displayed with anywhere from 3 to 77 characters. To select a global column width, you must type /GC followed by the number of characters you want to display in each cell.

As with all format commands, /GC alters only the *appearance* of the cells that you examine when you scroll the CRT "window". It does not change their contents. Although /GC changes the width of all columns on the worksheet, by splitting the window you can actually have two sets of column widths on the same worksheet.

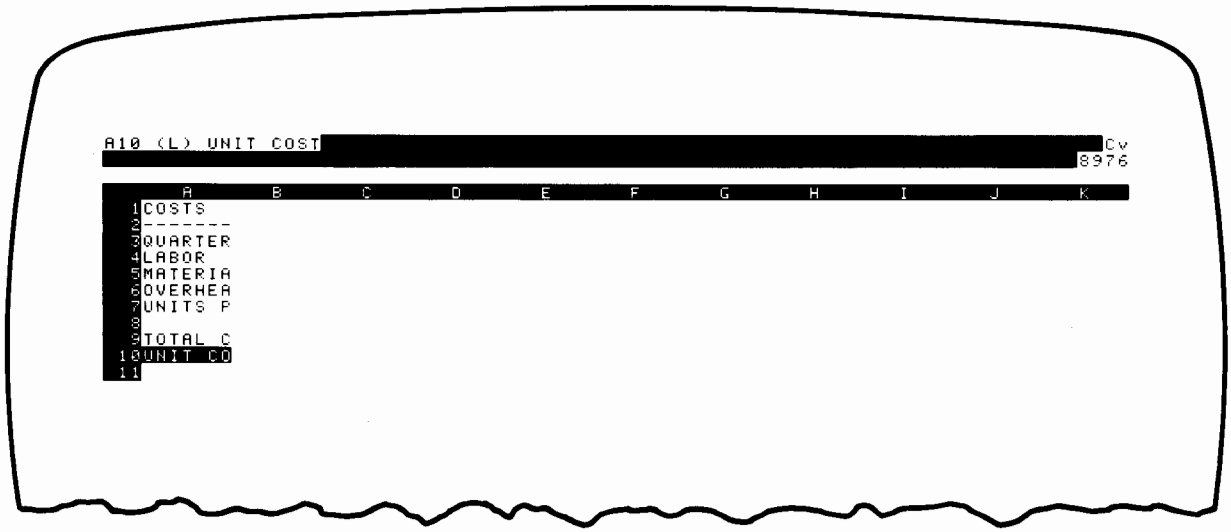
Example. A company needs a worksheet that shows costs for labor, overhead and materials for each quarter of the fiscal year. It needs to obtain the total for manufacturing expenses, then divide by the number of units produced to arrive at a unit cost. Here are the figures:

Quarter	1	2	3	4
Labor	48399.73	49675.42	51288.66	50305.33
Materials	56466.00	58940.18	60288.00	59378.00
Overhead	2388.91	5679.79	1434.00	5622.61
Units Produced	11000	15689	22380	35600

To begin setting up the worksheet:

Press /CY COSTS ↓ /-- ↓ QUARTER CONT LABOR CONT MATERIALS CONT OVERHEAD CONT UNITS PRODUCED CONT ↓ TOTAL COST CONT UNIT COST END LINE

VisiCalc Display

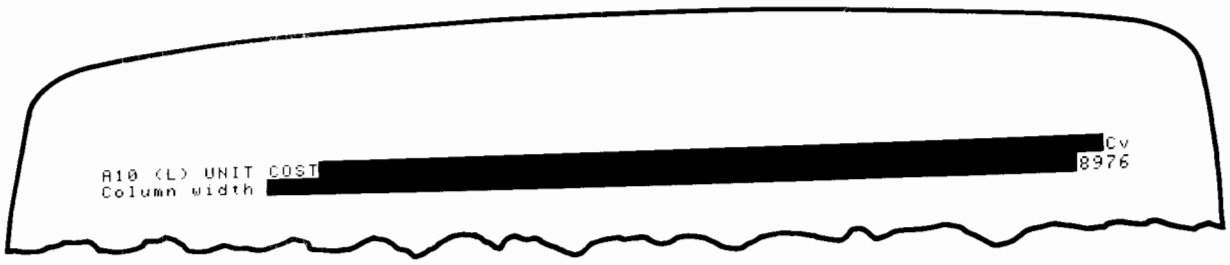


Notice that many of the labels you're using for titles have been truncated, cut off, because VisiCalc is currently formatted to display only seven characters of each cell.

To see the complete titles, we'll first widen the column width to show 15 characters:

Press /GC

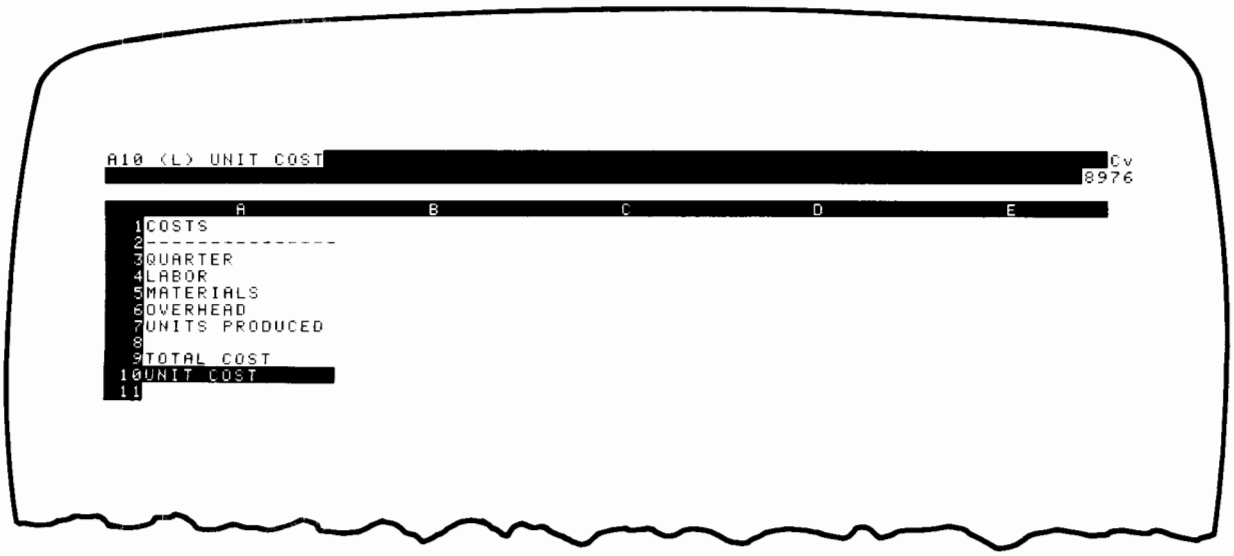
VisiCalc Status Area



VisiCalc is prompting you for the column width. You want to view 15 characters, so:

Press 15 (END LINE)

VisiCalc Display

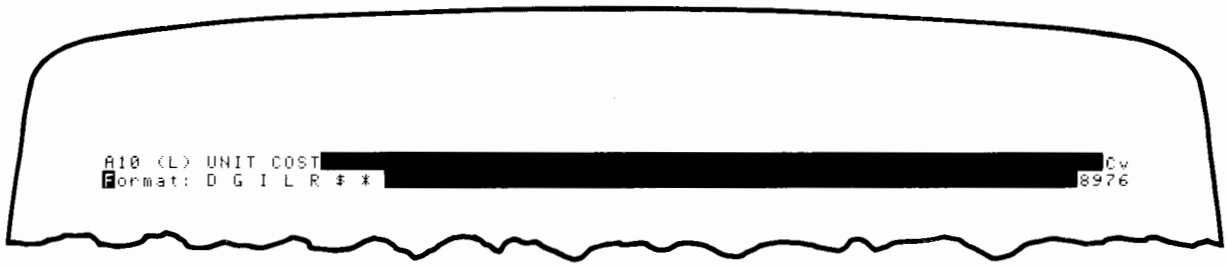


Now you can read all of each title. Notice that the repeating labels, the dashes, in cell A2 were automatically extended to fill the cell.

Since most of our numbers will be dollars and cents, we'll specify a global dollars and cents format:

Press /GF

VisiCalc Status Area



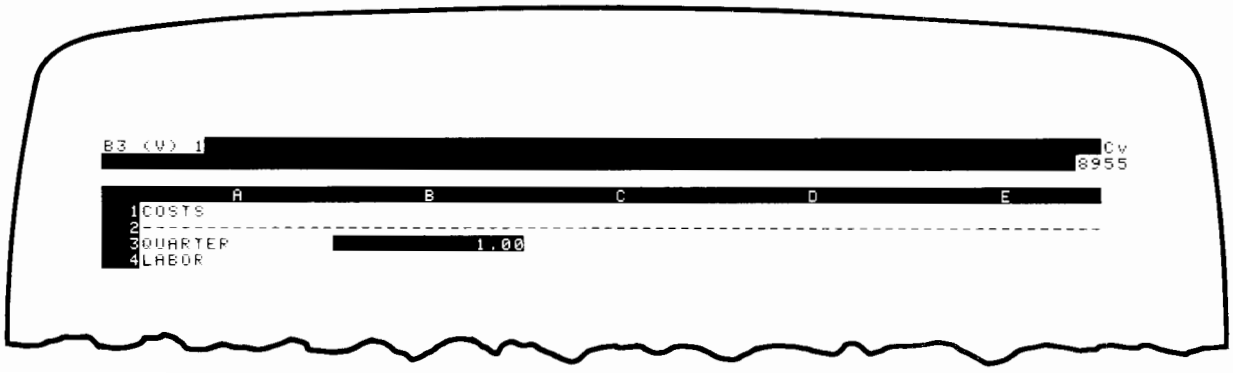
Press $

VisiCalc Status Area

Now let's type in the numbers and formulas. First, the numbers for the four *quarters*:

Press > A2 END LINE /R END LINE B2 . E2 END LINE > B3 END LINE 1 END LINE

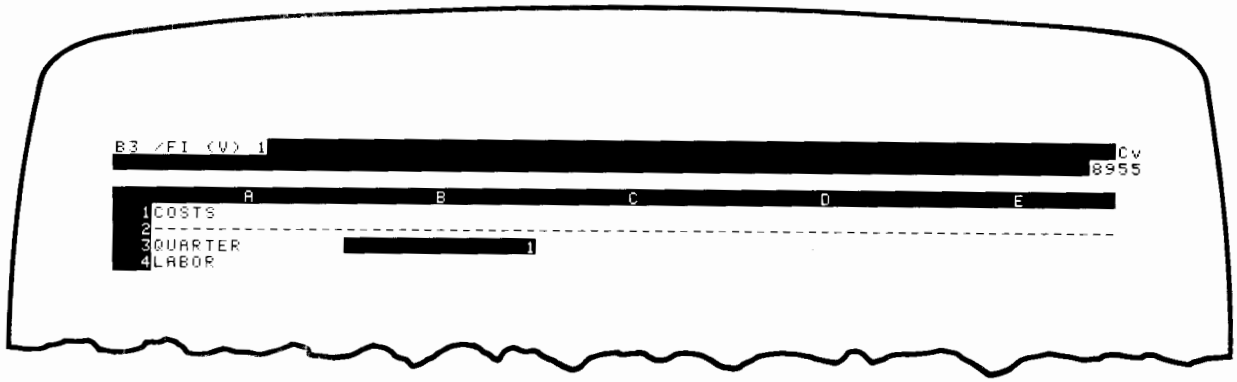
VisiCalc Display



You can see that although we'll probably want most of the values on our worksheet to be in dollars and cents format, with numbers shown to two decimal places, the values for *quarter* would be easier to read if they were in integer format. So let's specify local integer format for the first number for *quarter*:

Press /FI

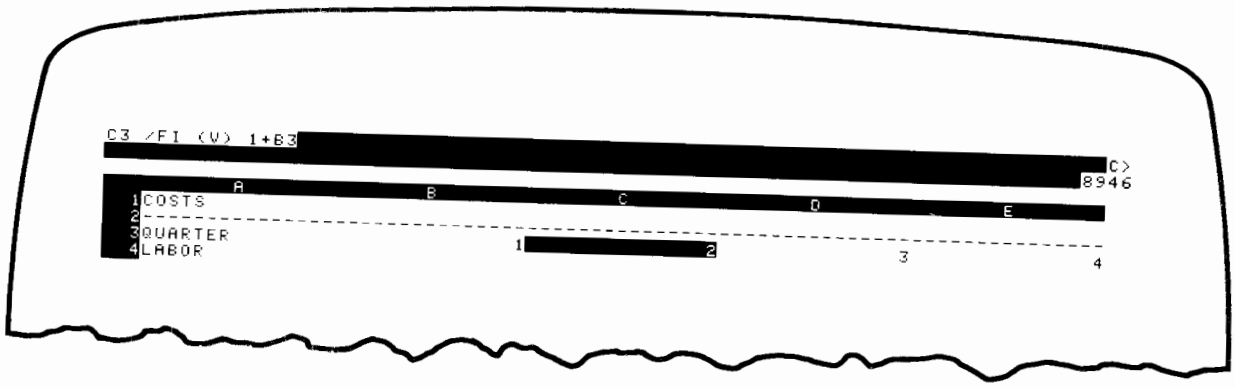
VisiCalc Display



Now we'll move to cell C3 to generate the formula for the rest of the quarters. We'll also repeat the local integer format specification and replicate it along with the formula for *quarter*:

Press → 1 + B3 END LINE /FI /R END LINE D3 . E3 END LINE R

VisiCalc Display

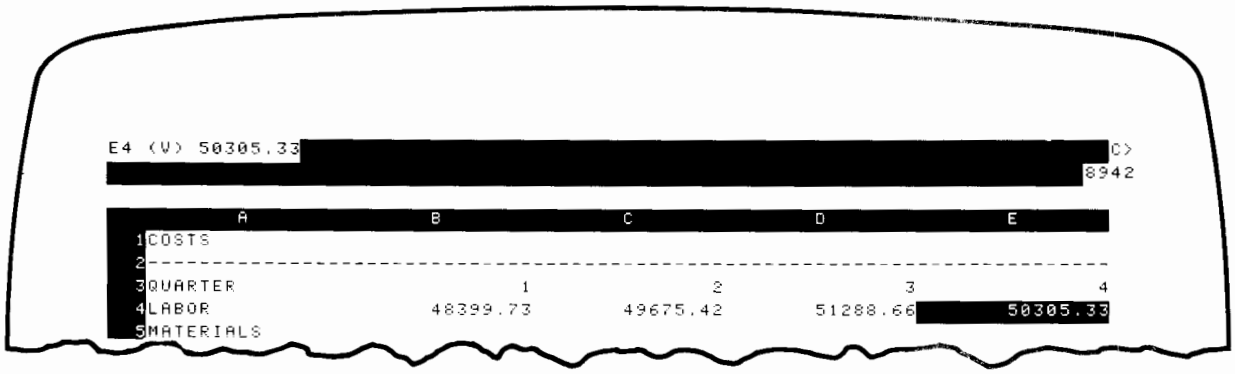


If you move the cursor out to column E, you'll see that both the formula and the format in cell B3 have been replicated.

Now add the values for *labor, materials,* and *overhead*:

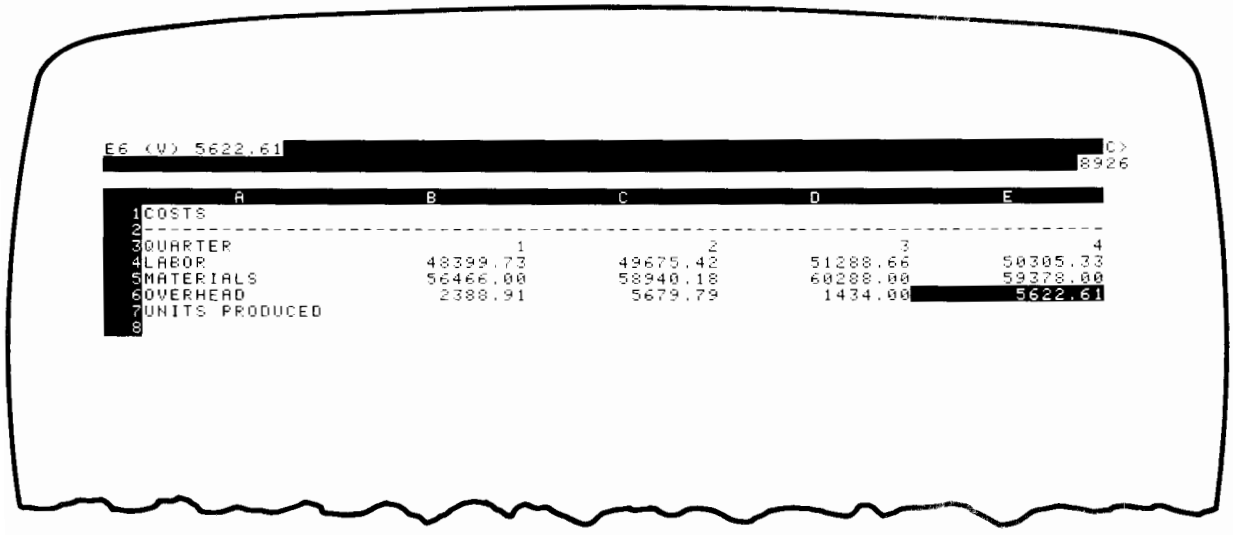
Press (>) B4 (END LINE) 48399.73 (→) 49675.42 (CONT) 51288.66 (CONT) 50305.33 (END LINE)

VisiCalc Display



Press (>) B5 (END LINE) 56466 (→) 58940.18 (CONT) 60288 (CONT) 59378 (END LINE) (>) B6 (END LINE) 2388.91 (→) 5679.79 (CONT) 1434 (CONT) 5622.61 (END LINE)

VisiCalc Display

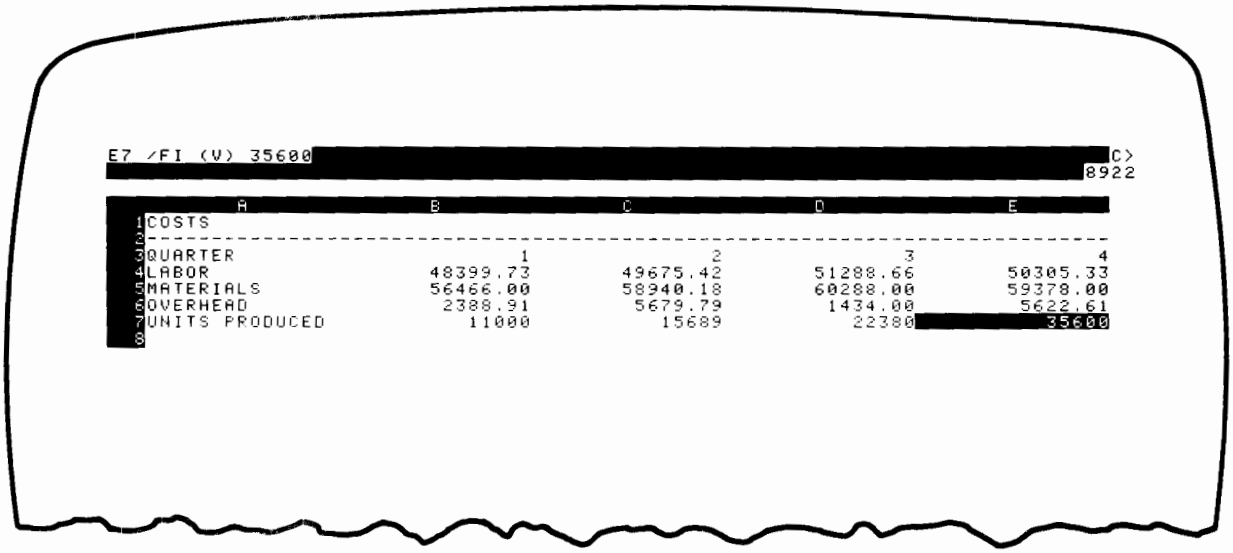


Notice that all these values appear in dollars and cents format (the global format) regardless of how they're typed in.

If we typed in the numbers for *units produced* now, they would also be displayed in the global dollars and cents format. Before we type in these values, we'll replicate a local integer format from cell B7 through cell E7:

Press (>) B7 (END LINE) /FI /R (END LINE) C7 (.) E7 (END LINE) 11000 (→) 15689 (CONT) 22380 (CONT) 35600 (END LINE)

VisiCalc Display

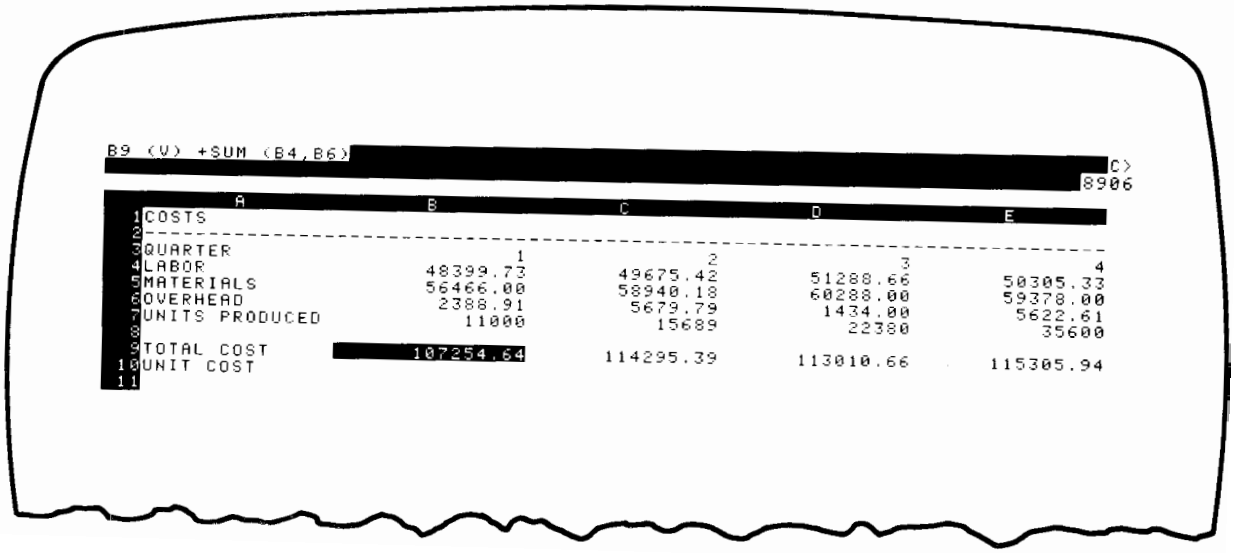


Now we'll figure the *total cost* and *unit cost* for each quarter. The *total cost* will be the sum of the values in rows 4, 5, and 6, and *unit cost* will be the *total cost* divided by the number of *units produced.*

To figure *total cost*:

Press (>) B9 (END LINE) + SUM(B4,B6) (END LINE) /R (END LINE) C9 (.) E9 (END LINE) R R

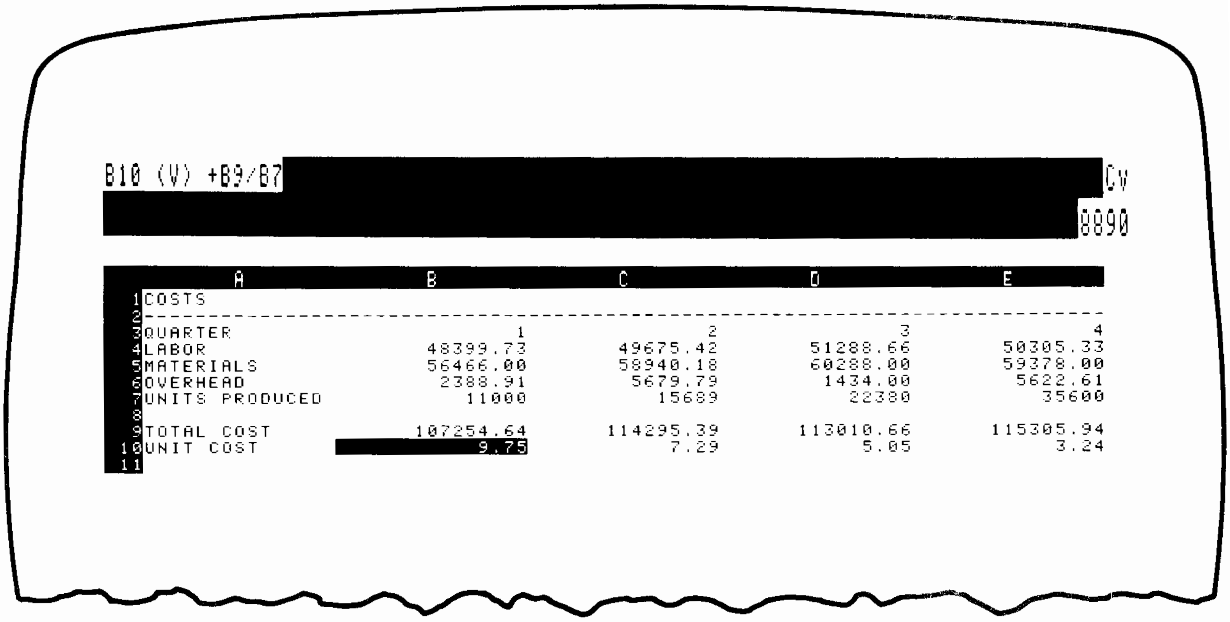
VisiCalc Display



Add to compute *unit cost*:

Press ⓘ + B9 / B7 [END LINE] /R [END LINE] C10 [.] E10 [END LINE] R R

VisiCalc Display

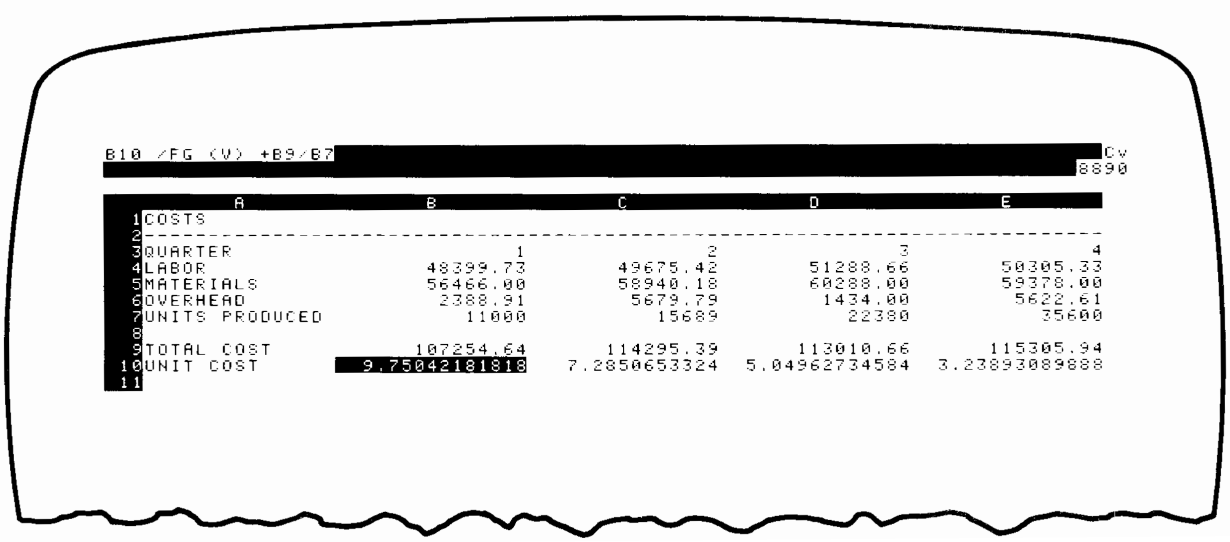


Now we have the manufacturing costs and unit price for all four quarters. If we move the cursor across to the fourth quarter, examining the *unit cost* as we go, we can see that the cost has fallen substantially, indicating that the manufacturing operation is becoming more efficient.

We have just one more change to make. Let's examine our *unit cost,* in row 10, to as many decimal places as possible. We could use the [RESLT] key at this point, but since we want to see all unit costs, we'll specify the *general* format:

Press [>] B10 [END LINE] /FG /R [END LINE] C10 [.] E10 [END LINE] R R

VisiCalc Display



Now we have a useful display of our worksheet. As you can see, the format commands give you maximum flexibility in the way you view your VisiCalc worksheet.

Changing Page Size

The /GP (*global page size*) command is a feature of VisiCalc which provides you with control over the number of worksheet rows which are displayed on the CRT screen. Like the PAGESIZE command of HP BASIC, /GP allows you to switch the display between 16 and 24 lines. This command provides flexibility in using the 80-column screen.

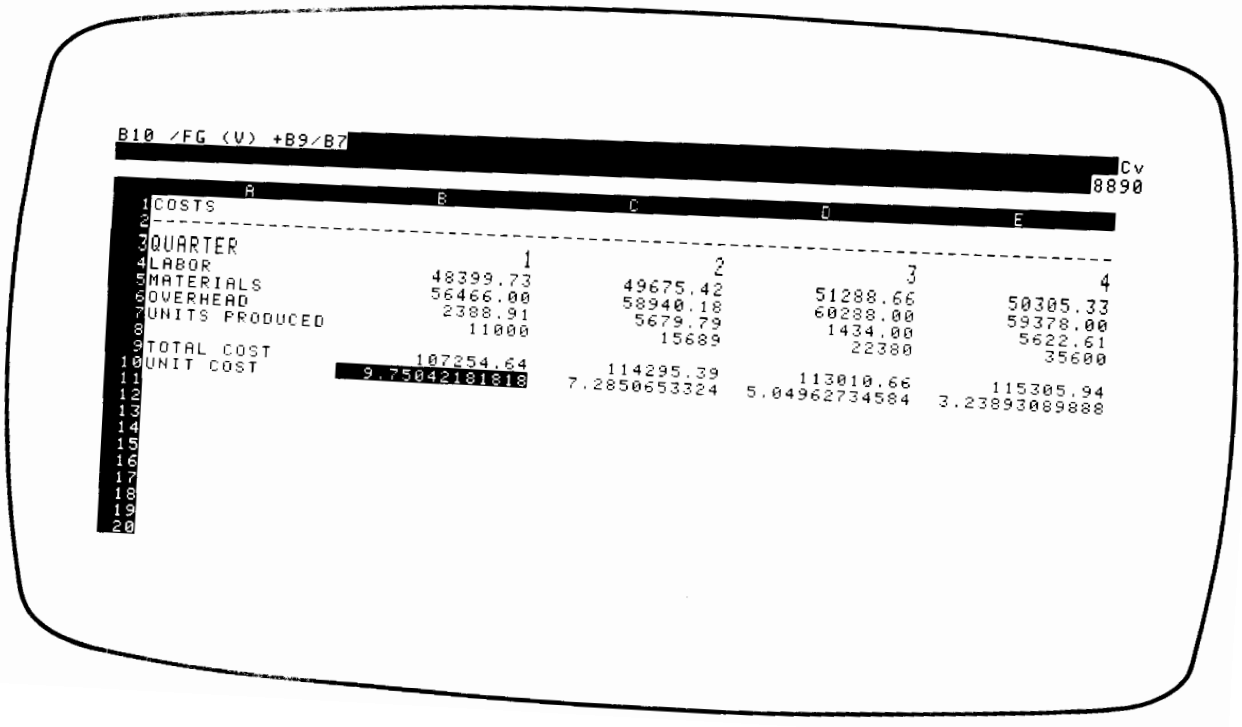
The status area and the top coordinate axis occupy 4 lines, so either 12 or 20 rows of the worksheet can be displayed.

When the VisiCalc program is loaded or the worksheet cleared with the /CY command, the page size is 16, so 12 rows are displayed. Every time /GP is executed the page size switches between 16 and 24 lines.

Let's switch the page size; notice the number of rows displayed:

Press /GP

VisiCalc Display

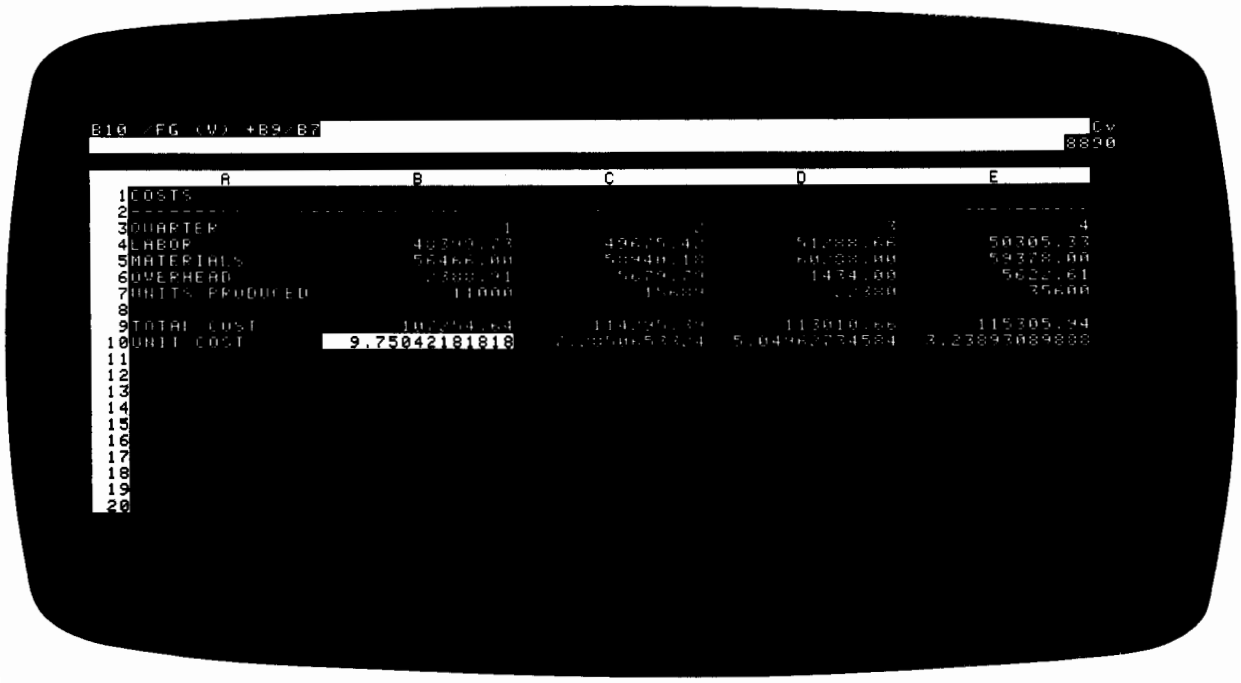


Changing the Background

The /GB (*global background*) command is a feature of VisiCalc which lets you use the inverse video capability of the computer. /GB changes the computer display's background color (black or white) to the opposite color. The /GB command changes only the background color; VisiCalc still operates in exactly the same way. The worksheet has a black background when the VisiCalc program is loaded, or when /CY is executed.

Press /GB

VisiCalc Display



Local Format Graphing

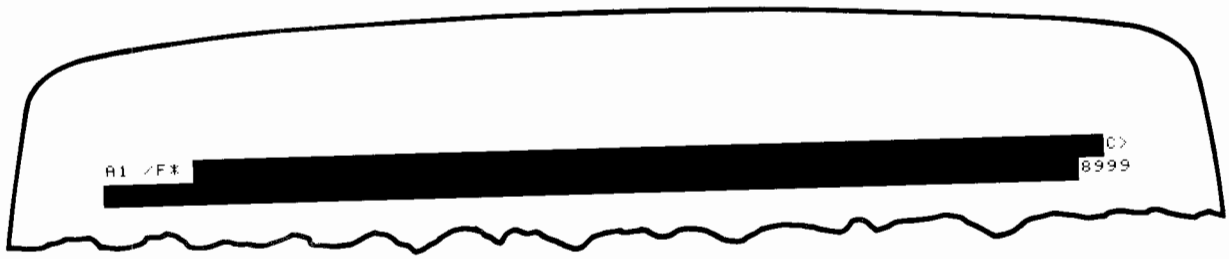
The asterisk format command, /F*, causes the display of the number of asterisks equal to the rounded integer portion of the value in the selected cell. If the value is negative, its absolute value is used. This can be used to create bar graphs of functions and values in VisiCalc.

As with all /F commands, /F* is a local format. To change the format of more than one cell at a time, you

Example. To replicate the graphing format, type the following:

Press /CY /F* /R END LINE A2 . A7 END LINE

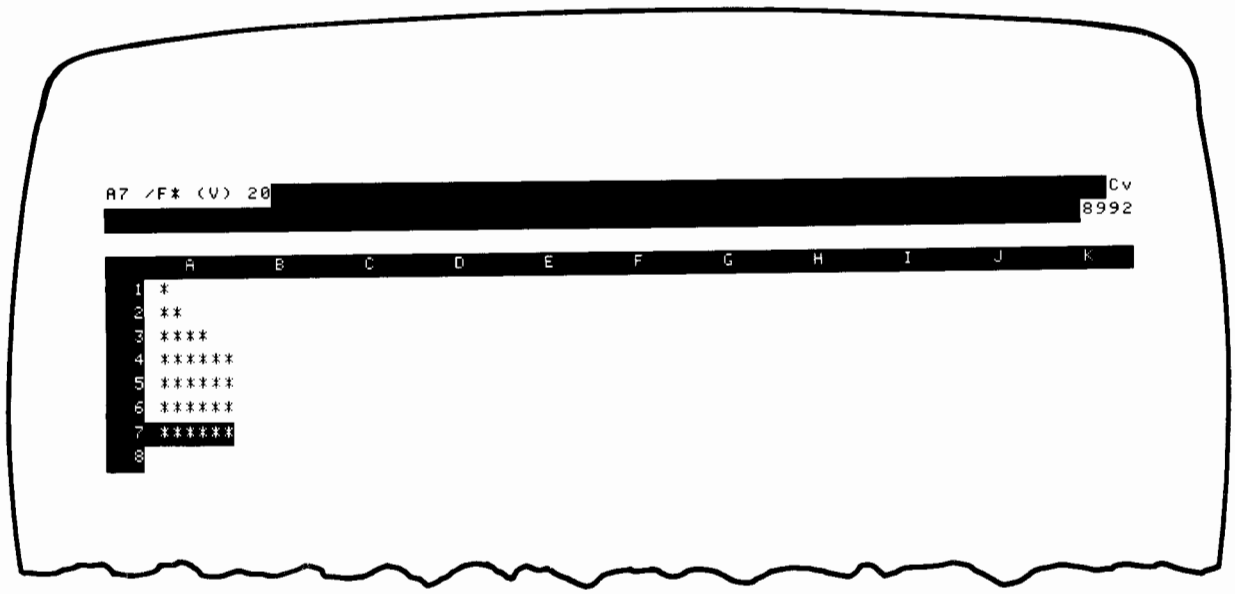
VisiCalc Status Area



The first seven cells in column A will now display their contents in the asterisk format:

Press 1 ↓ 2 CONT 4 CONT 6 CONT 8 CONT 9 CONT 20 END LINE

VisiCalc Display



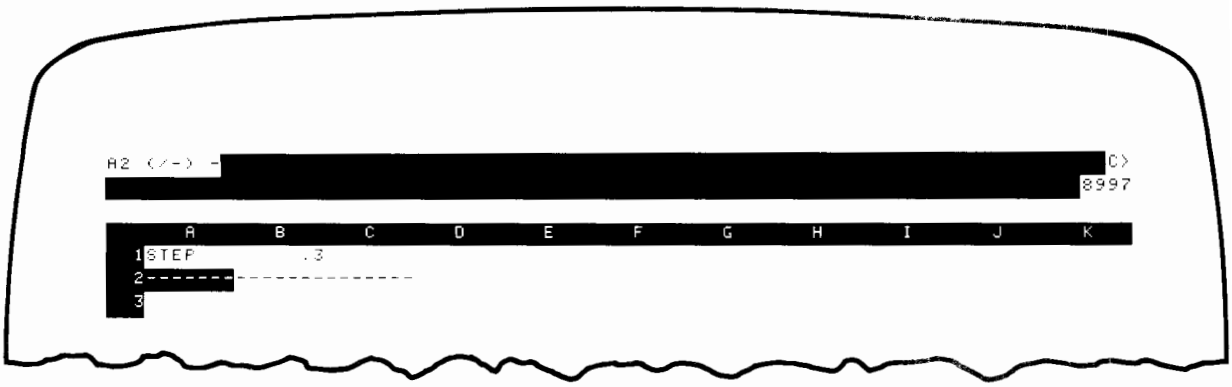
As you can see, if the integer portion of the value is too large, the asterisk format displays the maximum number of asterisks possible. Naturally, you can change the width of the cells to see a larger /F* display.

Example. Let's create a bar graph of the sine function SIN. We'll use a column width that will let us display each column up to 19 characters wide.

First we'll set the "start" and the "step" values for our graph. We'll start with the number 0, and increase the number by .3 each step:

Press /CY STEP → .3 END LINE > A2 END LINE /-- END LINE /R END LINE B2 . C2 END LINE

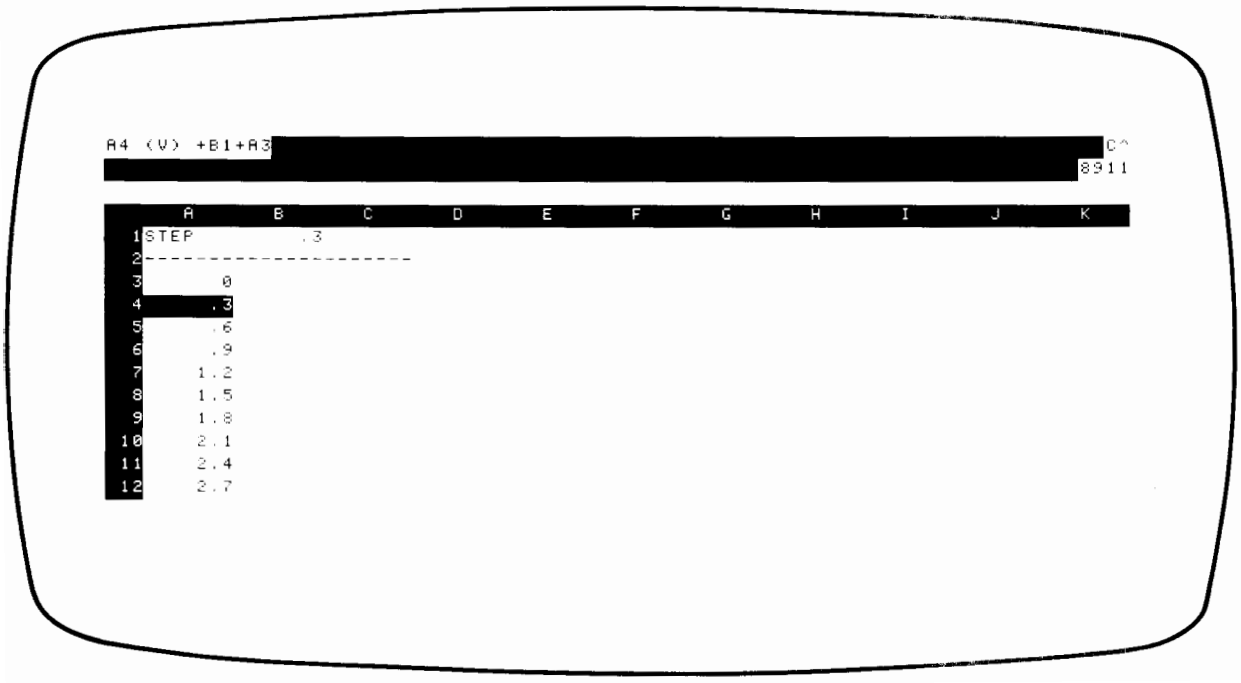
VisiCalc Display



Now we'll set up the sheet to use the step value to calculate 18 argument values for the sine function:

Press > A3 END LINE 0 ↓ + B1 + ↑ END LINE /R END LINE A5 . A20 END LINE N R

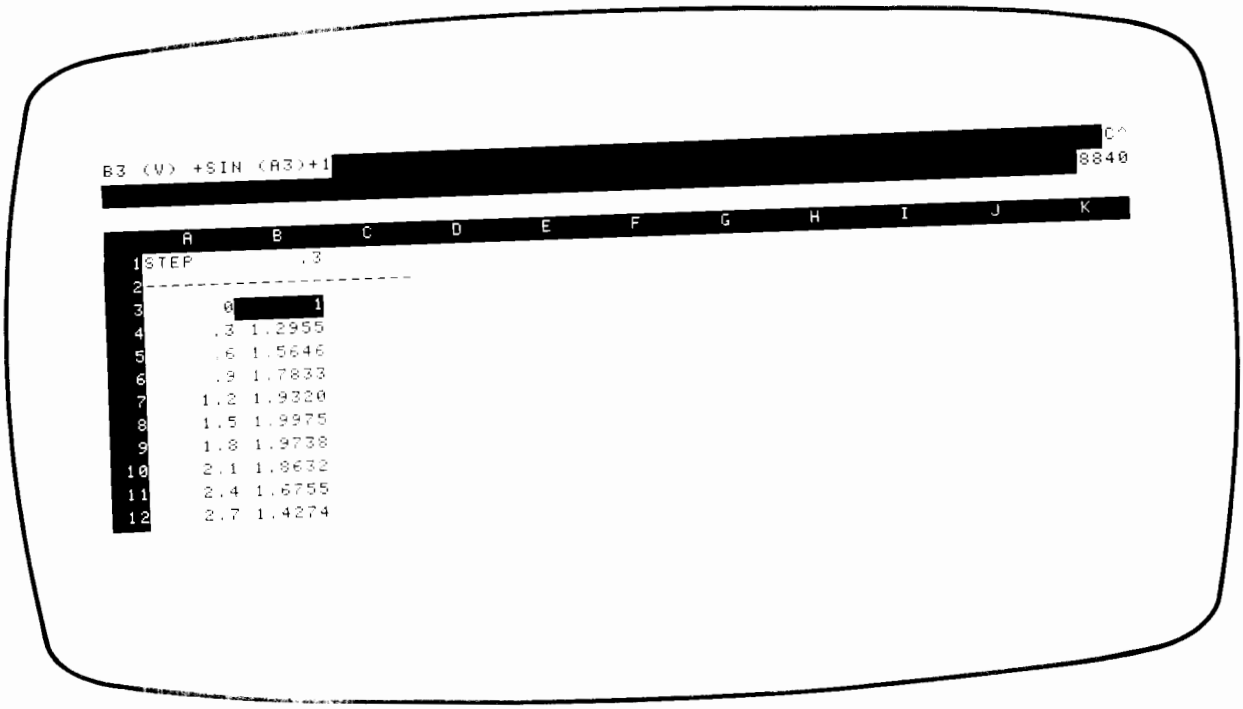
VisiCalc Display



Next, we'll use column B to calculate the corresponding results for the sine of each of the numbers in column A:

Press (>) B3 (END LINE) + SIN(A3) + 1 (END LINE) /R (END LINE) B4 (.) B20 (END LINE) R

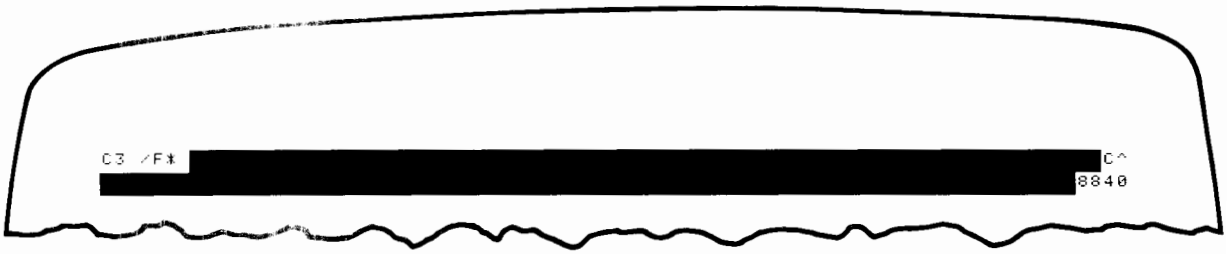
VisiCalc Display



Now we will set the graphing column, column C, to the proper format by replication:

Press (>) C3 (END LINE) /F* /R (END LINE) C4 (.) C20 (END LINE)

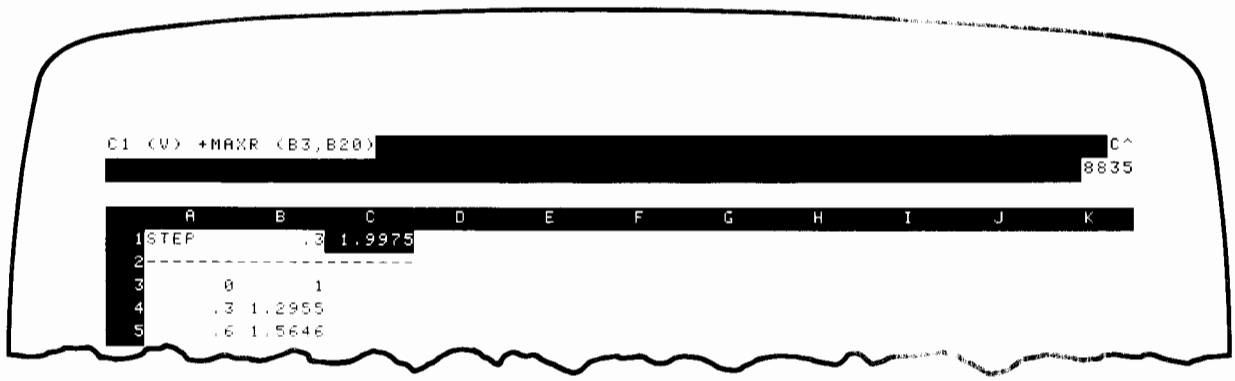
VisiCalc Status Area



All that is left to do is to scale the function values and represent them in asterisk format. We "scale" them by making sure the maximum value of the function reaches just out to the edge of our graph (19 places). Notice that we have written our equation as + SIN(x) + 1; this will lift the true graph up one unit, eliminating complications from negative function values. In order to "scale" our function values, we need to find the maximum:

Press > C1 END LINE + MAXR(B3,B20) END LINE

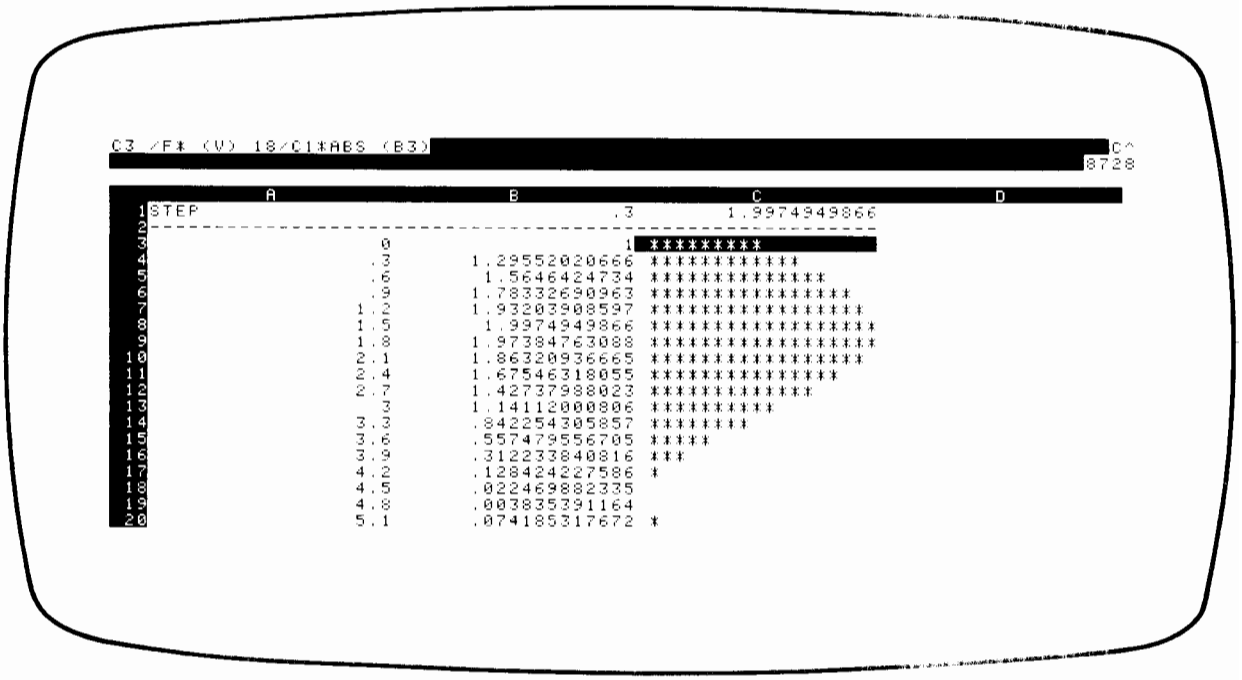
VisiCalc Display



Now we graph!

Press > C3 END LINE 18 / C1 * ABS(B3) END LINE /R END LINE C4 . C20 END LINE N R /GC 19 END LINE /GP

VisiCalc Display



The /GC (*global column width*) command changes the width of each column on the worksheet to the specified number of displayed characters. We need to increase the number of characters displayed to get better detail on our graph.

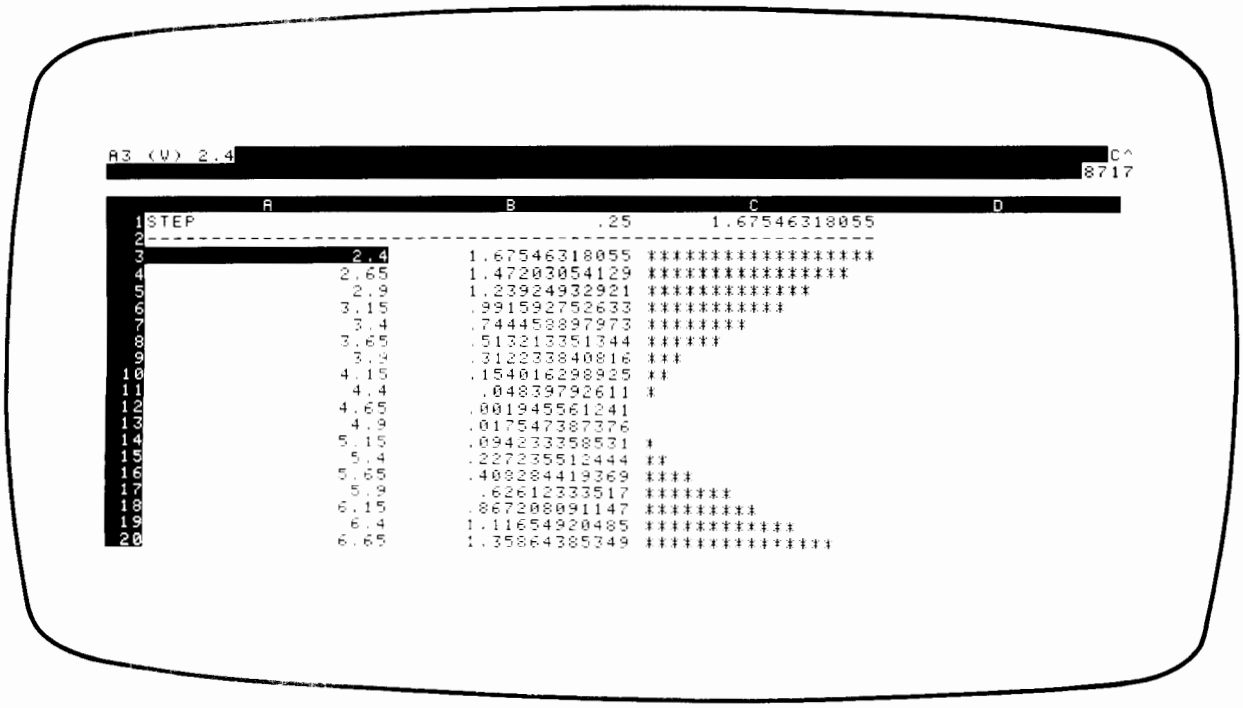
The /GP (*global page size*) command changes the number of rows displayed on the worksheet between 12 and 20. We need to increase the number of displayed rows to see more of the graph.

The formula 18 / C1 * ABS(B3) is our scaling function. Its general form is: (*column width* −1) / (*maximum function value*) * ABS(*value*).

We can easily adjust the graph. This is allowable, since most of the worksheet is calculated from formulas automatically. We could change the width of the graph, the step size (resolution), or the starting point:

Press (>) B1 (END LINE) .25 (END LINE) (>) A3 (END LINE) 2.4 (END LINE)

VisiCalc Display



If the sine graph doesn't look familiar, tilt your head sideways and imagine the X-axis on a column and the Y-axis on a row.

Overflow Display

For all formats, as column width is decreased, the display of values goes first to scientific notation and then to an "overflow" display, using the "greater than" (>) symbol. Here are some examples of automatic overflow:

Column Width	Value	/FG	/FI	/F$	/F*
7	106496	106496	106496	>>>>>>	******
6	106496	1.1E5	>>>>>	>>>>>	*****
5	106496	1E5	>>>>	>>>>	****
4	106496	1E5	>>>	>>>	***
3	106496	>>	>>	>>	**
7	12.36	12.36	12	12.36	******
6	12.36	12.36	12	12.36	*****
5	12.36	12.4	12	>>>>	****
4	12.36	12	12	>>>	***
3	12.36	12	12	>>	**

Even though a cell may overflow in the *display*, the actual cell contents remain unaltered within VisiCalc. To see the actual cell contents again, just change the column width or format.

Adjusting the Viewing Window

The computer's CRT screen is the viewing window through which you see part of the VisiCalc worksheet. This section illustrates how to set titles, vertically or horizontally, how to "split" the window to look at two separate parts of the worksheet at the same time, and how to scroll the two windows separately or together.

Fixing Titles

The *titles* command, /T, allows you to "fix" window title areas in VisiCalc. Once fixed in place, the title areas cannot be moved or altered by the cell cursor, so you can set up a titled worksheet "form" that remains immune to the other labels or values that are entered. As the screen is "scrolled" across the worksheet, the fixed titles remain visible.

To use the title command, first set the cell cursor to the bottom- or right-most area you want "fixed", then press /T. When you press /T, the prompt line displays **T**itles: **H**orizontal **V**ertical **B**oth **N**one. Here are the title commands:

/TH *Horizontal.* Fixes a horizontal title area consisting of one or more rows, including the row in which the cell cursor rests and all rows currently on the worksheet above the cell cursor.

/TV *Vertical.* Fixes a vertical title area consisting of one or more columns, including the column in which the cell cursor rests and all columns currently on the worksheet to the left of the cell cursor.

/TB *Both.* Fixes both horizontal and vertical title areas at the same time, including the row and column where the cell cursor currently rests, all rows on the worksheet above the cell cursor, and all columns on the worksheet to the left of the cell cursor.

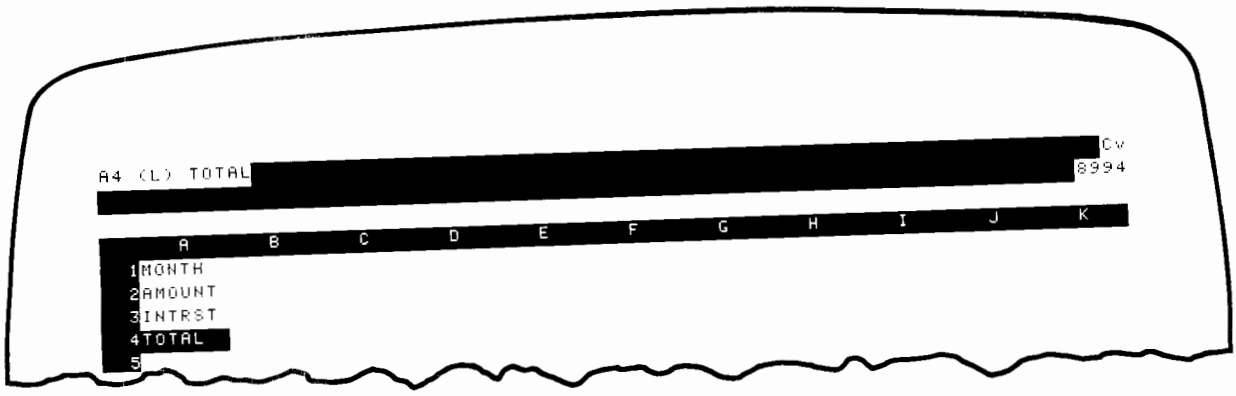
/TN *None.* Resets the worksheet to have no fixed title areas. This command operates regardless of the cell cursor location.

Example. You have $1072 to invest in an annuity that is projected to grow at an annual rate of 15%, compounded monthly. Let's arrange the VisiCalc worksheet to give you a monthly schedule of the *beginning amount* in the annuity, the *interest* paid for the month, and the *total* after interest is paid.

First we'll set up the titles:

Press /CY MONTH ↓ AMOUNT CONT INTRST CONT TOTAL END LINE

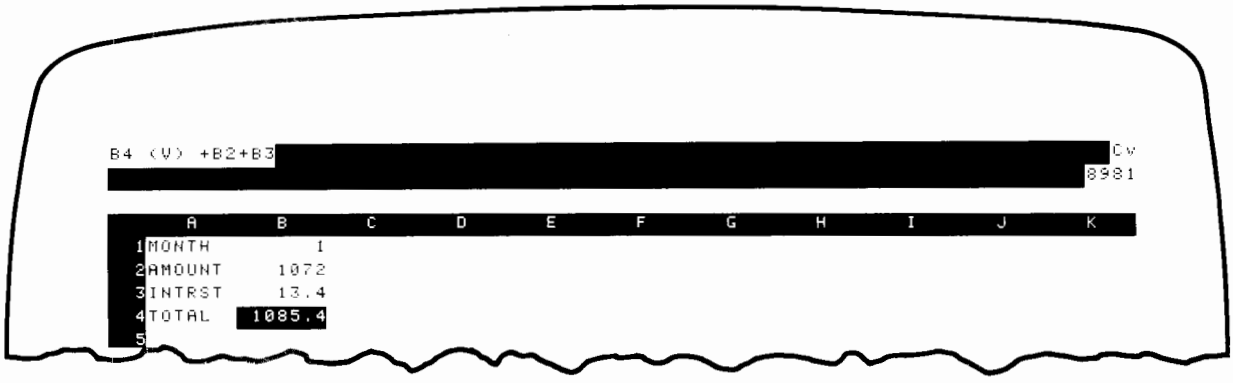
VisiCalc Display



Now we'll add the formulas to give our monthly figures:

Press > B1 END LINE 1 ↓ 1072 CONT .15 / 12 * B2 CONT + B2 + B3 END LINE

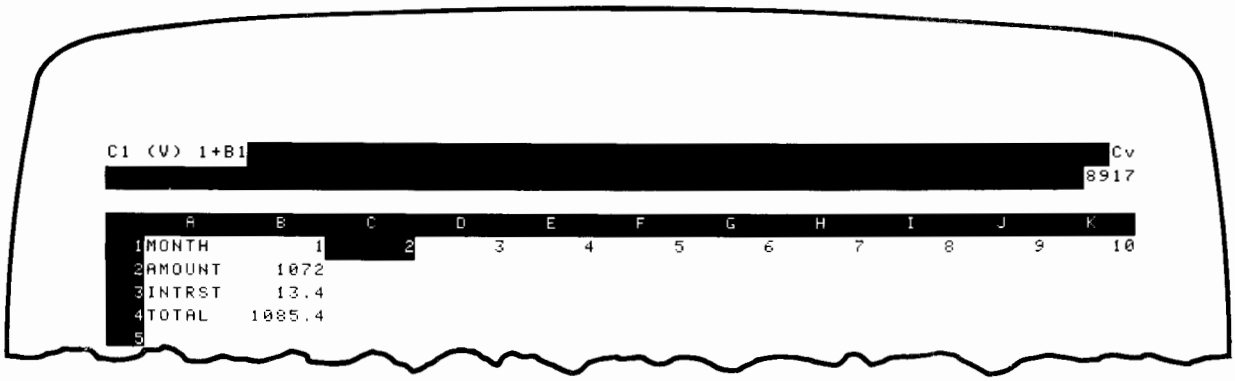
VisiCalc Display



Now we'll use the *replicate* command to repeat our formulas out to column M (month #12). First, for the months we simply repeat the number for the first month, adding 1 to it each time:

Press (>) C1 (END LINE) 1 + B1 (END LINE) /R (END LINE) D1 (.) M1 (END LINE) R

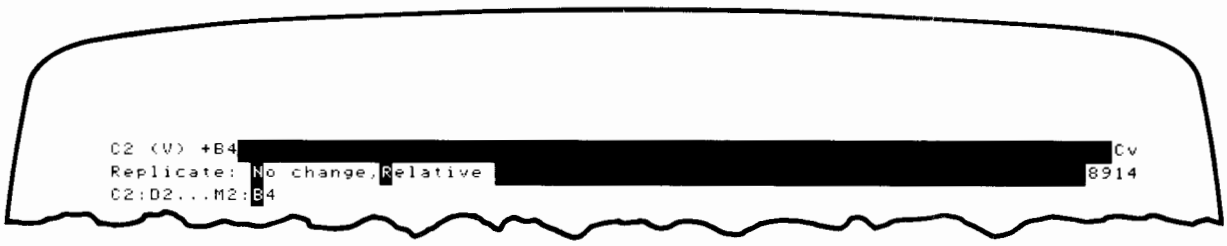
VisiCalc Display



The *beginning amount* for a month is simply the *total* for the previous month:

Press (↓) + B4 (END LINE) /R (END LINE) D2 (.) M2 (END LINE)

VisiCalc Status Area

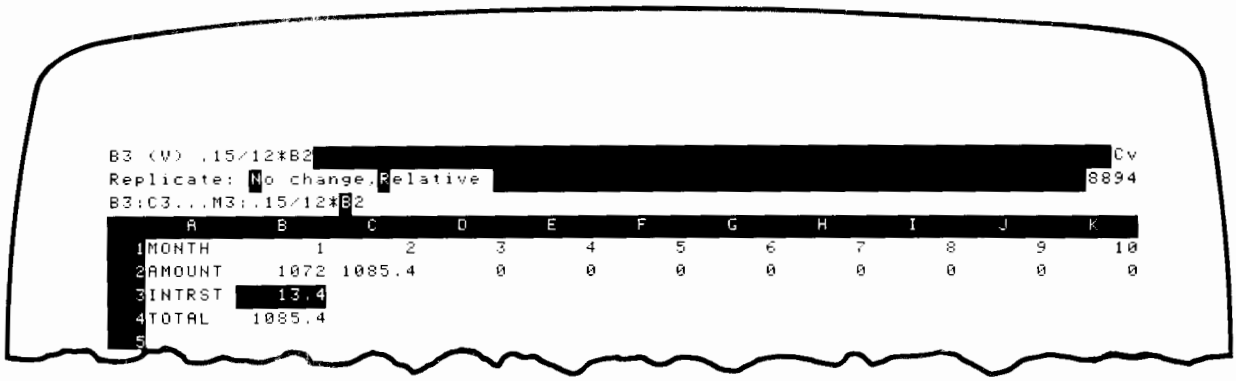


Press R

All of the zero entries will disappear when we get some numbers for their formulas to use. The formulas for interest and total in rows 3 and 4 are simply replicated across the columns:

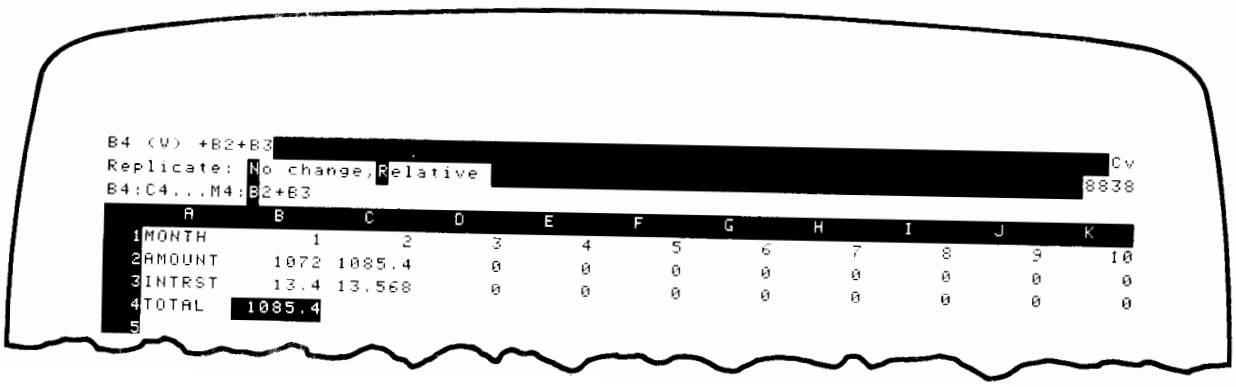
Press (>) B3 (END LINE) /R (END LINE) C3 (.) M3 (END LINE)

VisiCalc Display



Press R (↓) /R (END LINE) C4 (.) M4 (END LINE)

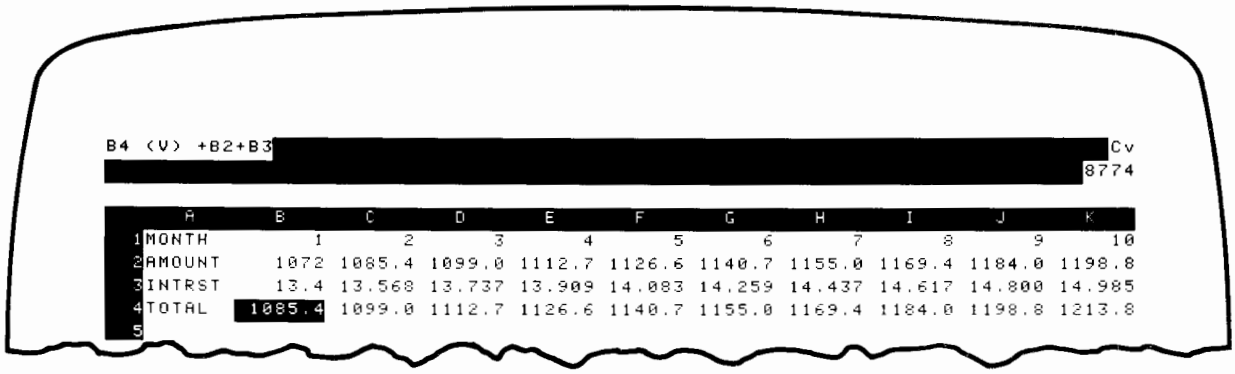
VisiCalc Display



Press R R

At this point the window on your worksheet should look like the display shown here:

VisiCalc Display



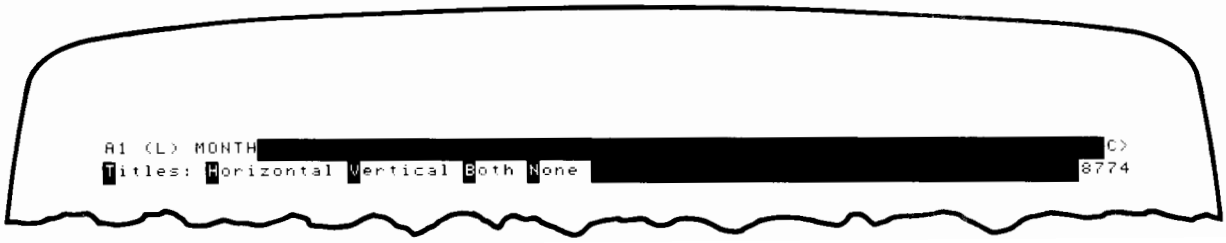
As you know, in order to see the beginning amount, interest, and total for each month, you can scroll the window out to column M, the 12th month. If you do, though, the titles will be scrolled to the left off the CRT screen as the window moves to the right.

The *titles* command lets you fix those titles in place, so that even as you scroll the window to the far right of the worksheet, the title for each row remains visible.

To fix the column of *vertical* titles, just set the cell cursor to the column you want fixed, then use the *titles* command, /T:

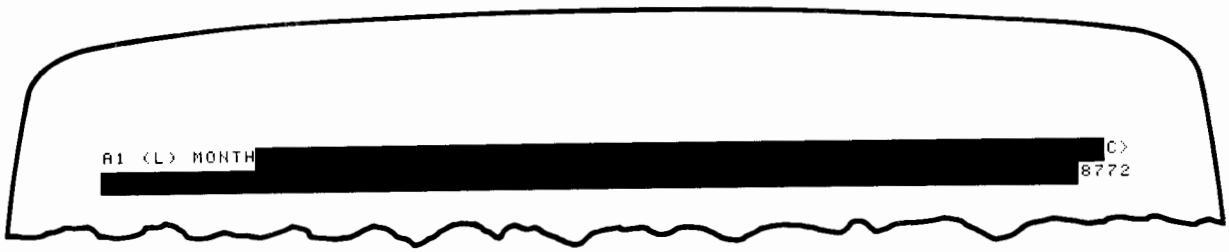
Press ↖/T

VisiCalc Status Area



Press V

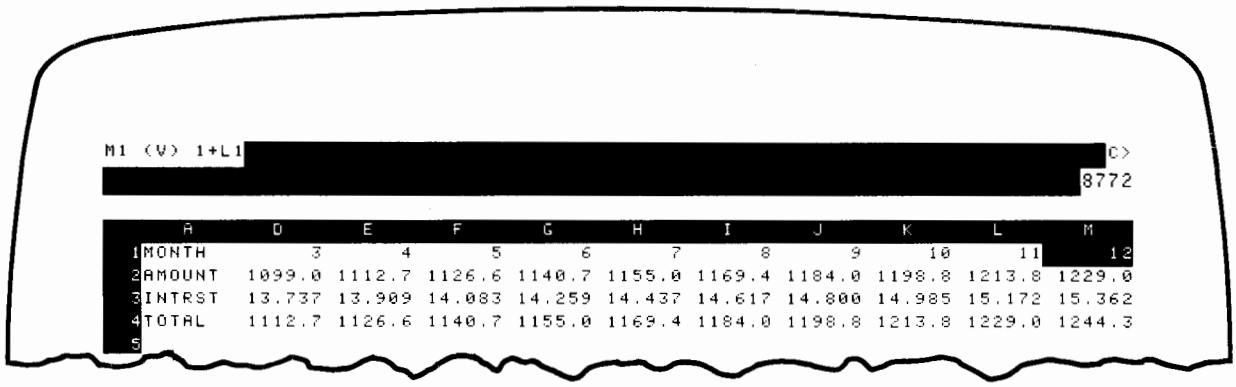
VisiCalc Status Area



You've fixed the column of *vertical* titles in the window. Now, if you scroll the window out to the 12th month, the titles remain at the left of the display, labeling your cell contents:

Press and Hold →

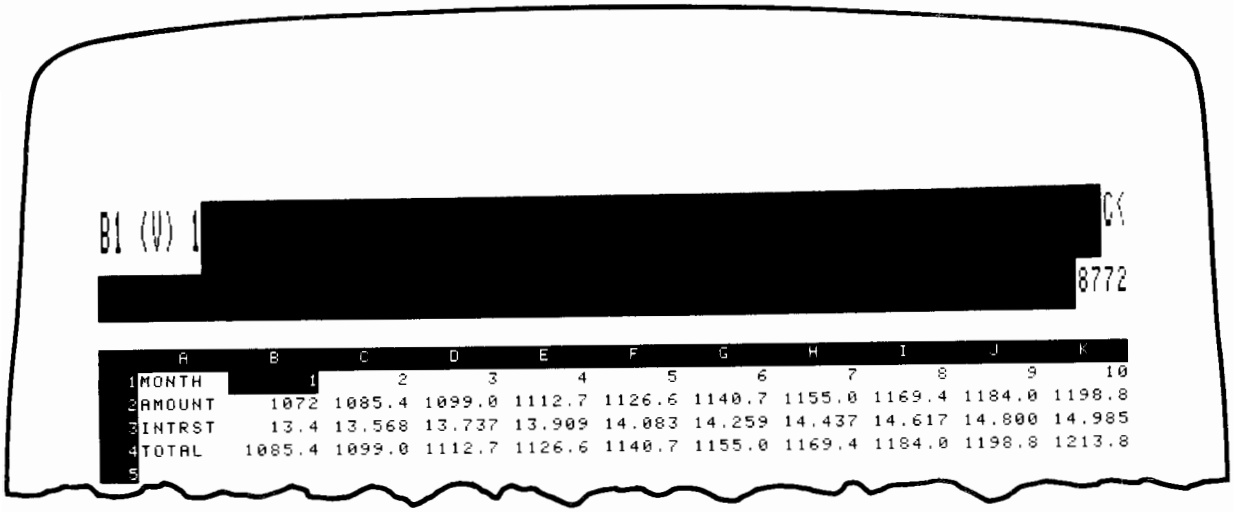
VisiCalc Display



To keep you from mistakenly changing a fixed title, you cannot use the cursor movement keys, ↑, ↓, →, ←, to move the cell cursor into a fixed title area. (You can use ↖, however.) To try it, scroll back to the left side of the worksheet:

Press and Hold ←

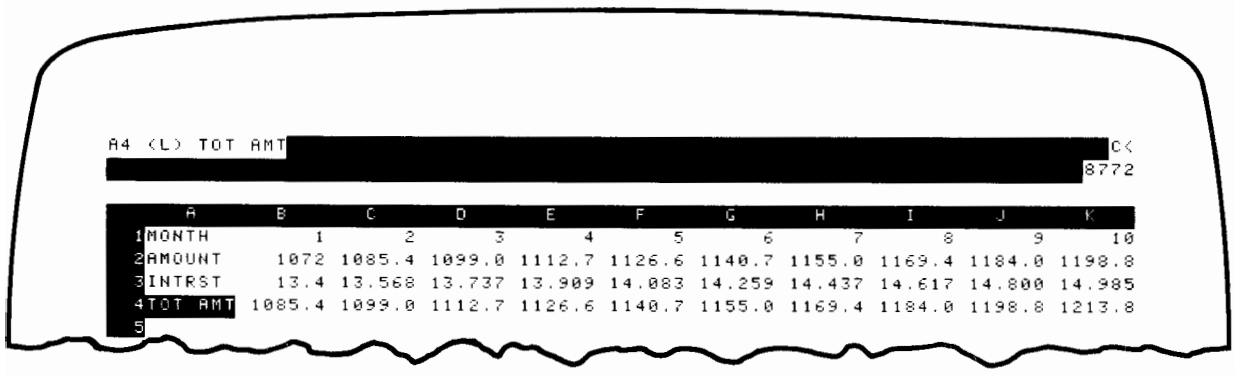
VisiCalc Display



The cursor beeped as it "bumped" against the fixed title area just as if it were the edge of the worksheet. To move into and edit a fixed title area, you can first use the /TN command to "unfix" all title areas, or you can use → followed by the cell coordinates of the desired title or ↖ to "home" the cursor ("home" is cell A1). For example, to change TOTAL to TOT AMT:

Press → A4 END LINE TOT AMT END LINE

VisiCalc Display



The title area remains fixed.

Just as you fixed a vertical title area with /TV, you can also fix a horizontal area with /TH, or both horizontal and vertical areas with /TB.

Splitting the Window

Another option you have in the way the VisiCalc "window" looks at the worksheet is splitting the window to look at two parts of the worksheet at once. You can choose to scroll the two areas of the split window together or separately.

The *window* command, /W, allows you to split the window in VisiCalc. When you press /W, the prompt line displays Window: Horizontal Vertical 1 Synchronized Unsynchronized to prompt you for further commands. Here are the window commands:

/WH *Horizontal.* Splits the screen horizontally into two windows between the cell cursor position and the next higher row. Places the cell cursor in the upper window.

/WV *Vertical.* Splits the screen vertically into two windows between the cell cursor position and the next left-hand column. Places the cell cursor in the left window.

/W1 Returns the screen to *one* window.

/WS *Synchronize.* Allows scrolling to be synchronous for both windows. When synchronous scrolling is specified, the window without the cell cursor will scroll to achieve proper row or column indexing. A vertically split screen allows vertical synchronous scrolling, and a horizontally split screen allows horizontal synchronous scrolling.

/WU Returns scrolling to the *unsynchronized* condition, so that only the window containing the cell cursor will be scrolled. Scrolling is unsynchronized when VisiCalc is first loaded or cleared with /CY.

When you split the window, the second window is highlighted like the first, with the one-line upper border with column designators (A, B, C ...) for a horizontally split window, or with the three-character left-hand border with row designators (1, 2, 3 ...) for a window that is split vertically.

When you split windows and return to one window, the width of the columns in the single window will be the same number of characters that were present in the last window to which the cell cursor was set. The actual contents of the cells are unchanged and you can specify any display width by using the /GC (*global column width*) command. Section 6 of this manual describes the use of the /GC command.

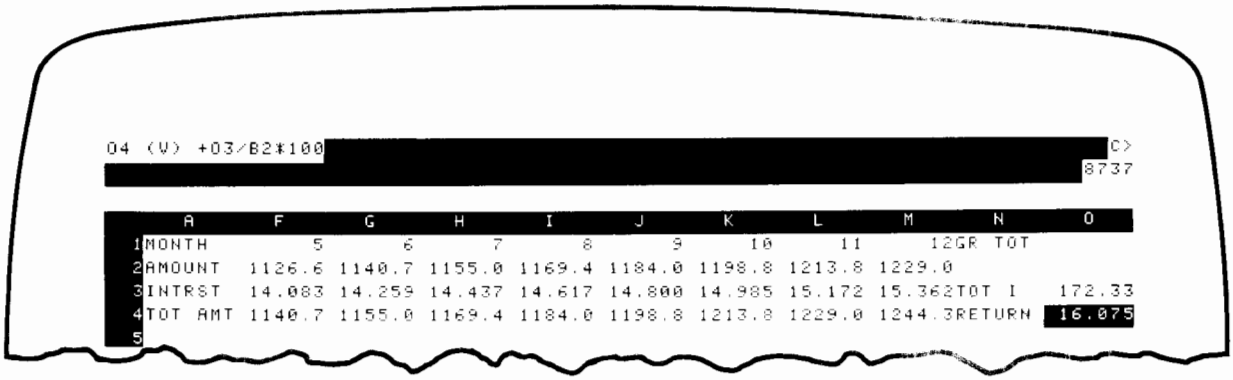
Among other uses, the split screen permits you to make changes at one part of the worksheet and examine the effects at another part.

Example. Add to the previous example another set of columns that show some *grand totals*: the *total interest* you would receive from the annuity in a 12-month period, and the actual percentage *return* on your investment. Then split the screen and watch how the totals change as you alter the original amount.

To add columns for grand totals:

Press (>) N1 (END LINE) GR TOT (↓) (↓) TOT I (→) + SUM(B3,M3) (END LINE) (←) (↓) RETURN (→) + O3 / B2 * 100 (END LINE)

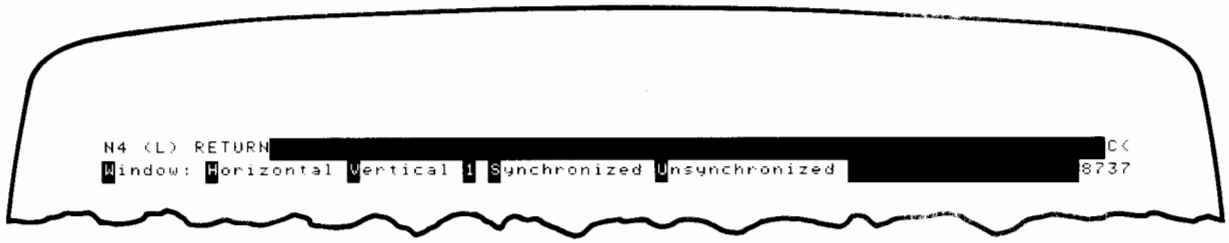
VisiCalc Display



To split the window, set the cell cursor to the first cell you want to be in the new window, then press /W. You then press V for a vertically split screen. (Before you split the window in this example, you should first "unfix" the titles. Otherwise, the fixed titles will also appear on the right-hand screen.)

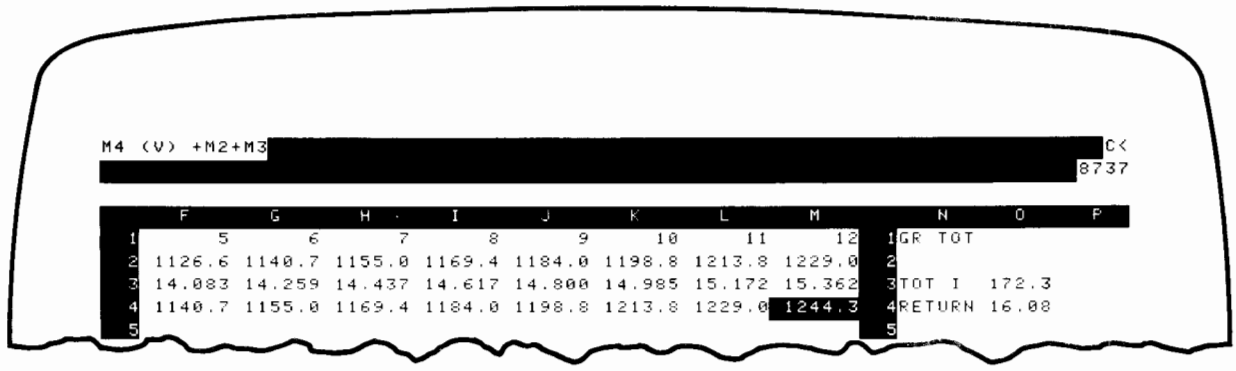
Press /TN → ← ← /W

VisiCalc Status Area



Press V

VisiCalc Display

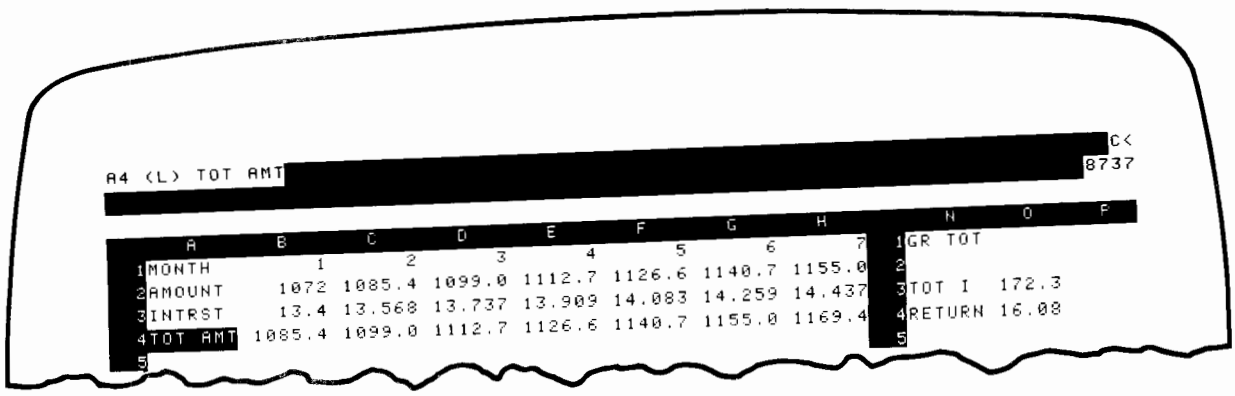


At this point, the VisiCalc window has split in two. You can see that the new window on the right contains row designators (1, 2, 3 ...) followed by your new set of labels and formulas.

Each screen window can be scrolled independently to view any portion of the worksheet. At present, the cell cursor is in the left-hand window at cell M4. Now use ← to scroll the cell cursor back to column A and look at your first set of labels and initial investment:

Press and Hold ←

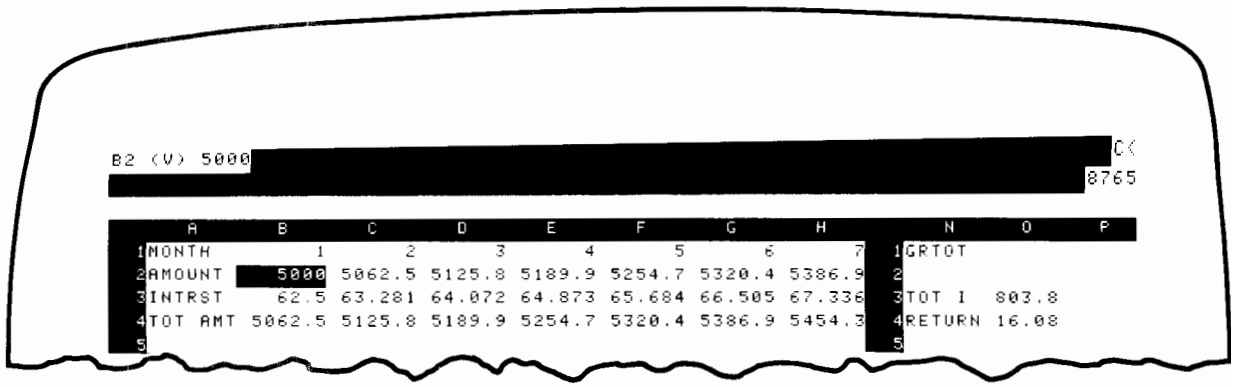
VisiCalc Display



Now suppose you wanted to see how much profit you could make if you invested $5000 instead of $1072. Change the value at cell B2 to 5000 in the left-hand window and watch the effect of the change on your total interest, TOT I, in the right-hand window:

Press > B2 END LINE 5000 END LINE

VisiCalc Display



Moving the Cell Cursor Between Windows

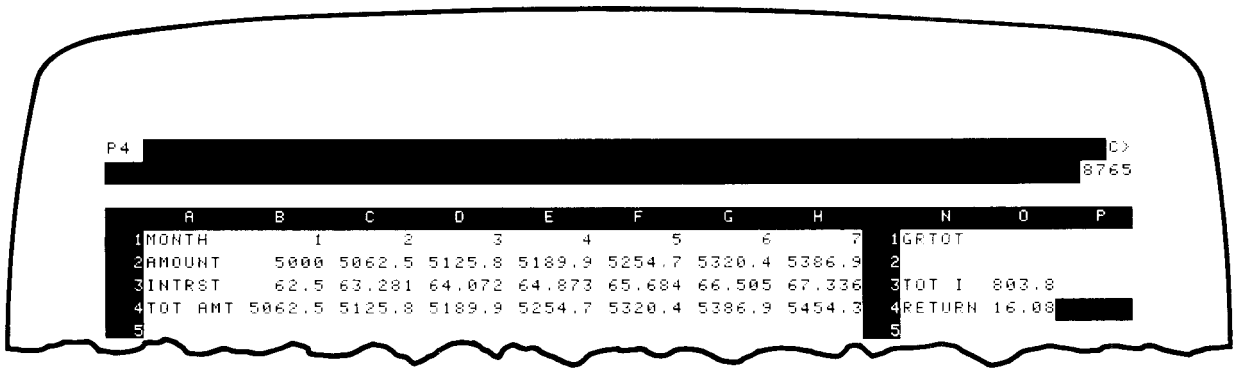
As you have seen, when the window is split in two, the cell cursor moves only within its present window; no matter how you move the cell cursor, whether with the cursor movement keys or >, only the current window is affected.

The semicolon is the only key that moves the cell cursor between windows. When you press (;) the cell cursor jumps to the other window. When you press (;) again, the cell cursor returns to its original position in the first window.

Try it now. Move the cell cursor to the last position it occupied in the right-hand window, and scroll that window, if you like:

Press (;)(→)(→)

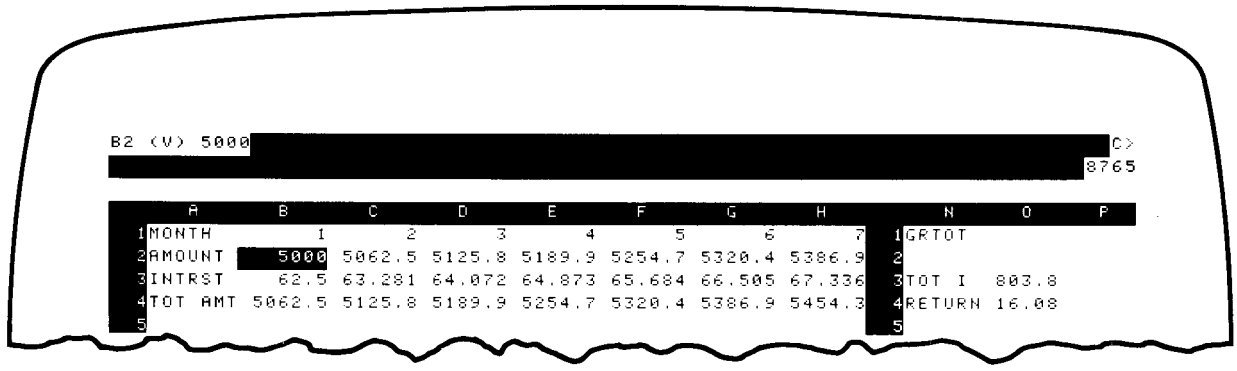
VisiCalc Display



Now return the cell cursor to the left-hand window:

Press (;)

VisiCalc Display



Notice that the cursor returned to the position in the left-hand window to which it was set just before exiting.

Scrolling the Windows

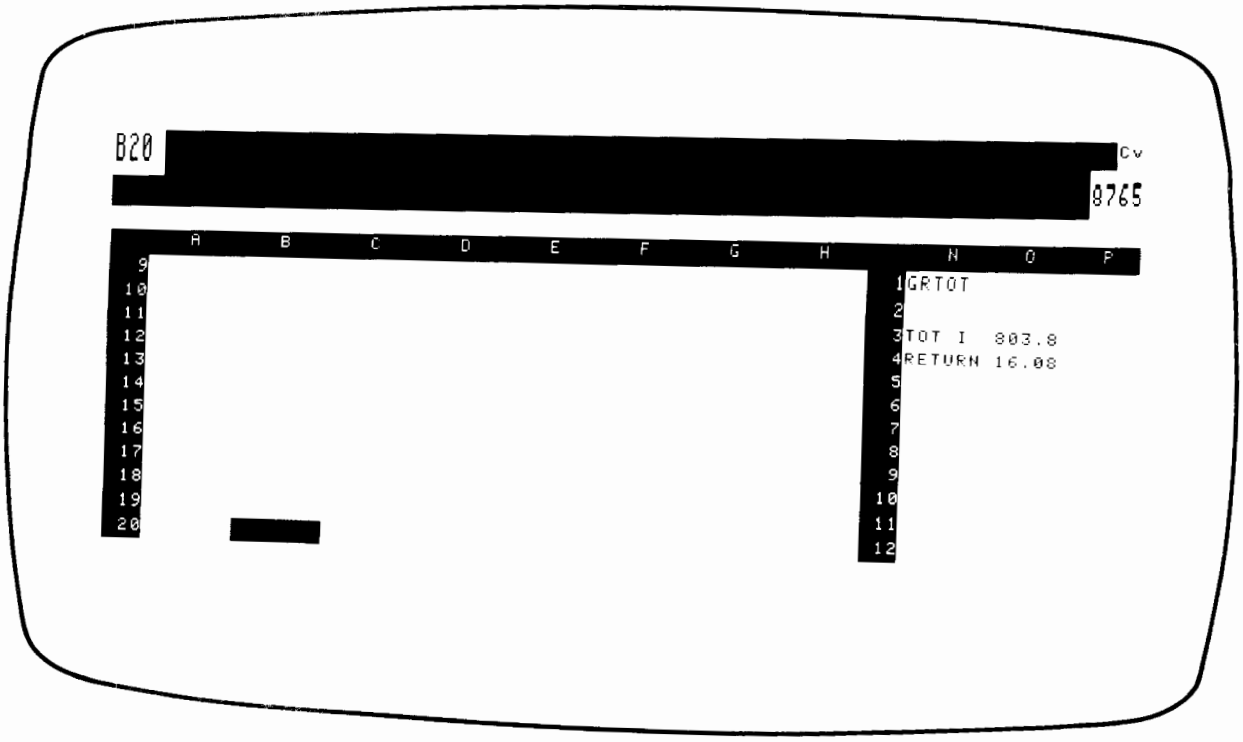
So far you have seen examples of *unsynchronized* scrolling of the two display windows; as you move the cell cursor, vertically or horizontally, only the window in which the cell cursor is located is scrolled. However, you can also specify *synchronized* scrolling of windows by using the /WS (*window synchronize*) command.

A pair of vertical windows can be synchronized vertically, while horizontal windows are synchronized horizontally. If the two windows are not already synchronized before the /WS command is executed, /WS synchronizes them, "locking" them together.

Let's first examine unsynchronized and then synchronized scrolling of our vertical windows. First, scroll the left-hand window down to row 20:

Press and Hold ↓

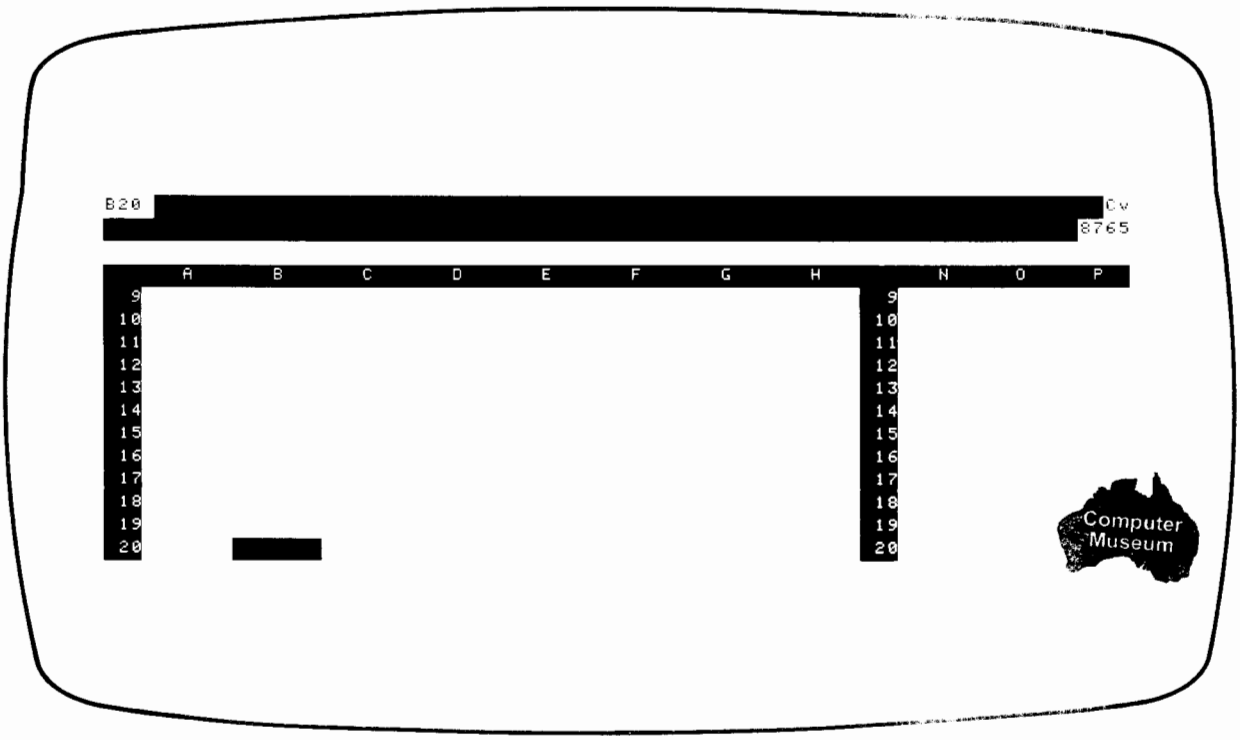
VisiCalc Display



Notice that the right-hand window was not scrolled, even though the left-hand window is now set to row 20. Now let's "lock" the two windows together for vertical scrolling:

Press /WS

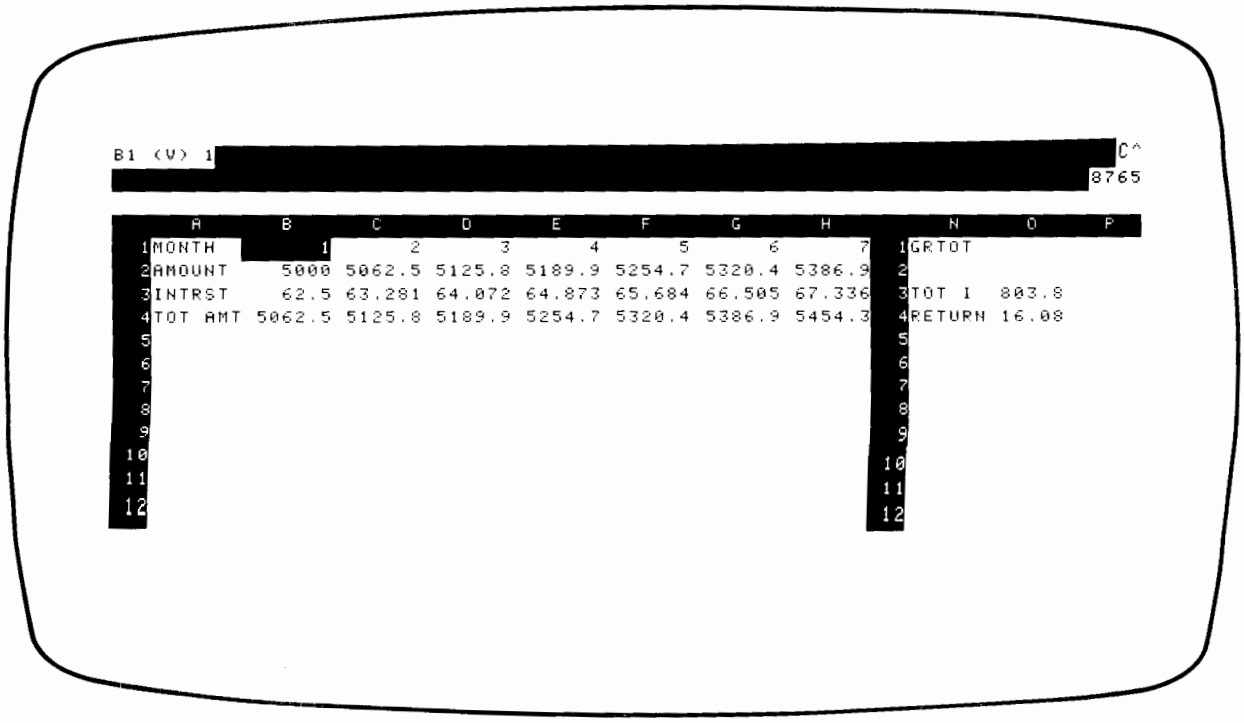
VisiCalc Display



When you execute the /WS command, the right-hand window is automatically moved until it is synchronized with the window containing the cell cursor. Now scroll both windows together back to the top of the worksheet:

Press and Hold ↑

VisiCalc Display



Observe that the two windows were scrolled together. Synchronous scrolling lets you scroll both windows together to examine two parts of the worksheet at the same time.

The VisiCalc Worksheet and Computer Memory

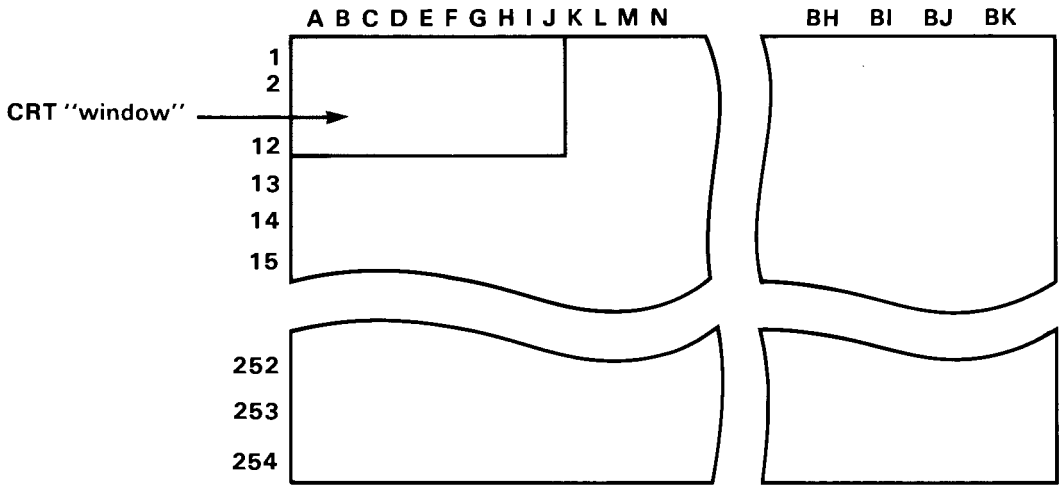
The VisiCalc program itself occupies a portion of the computer's available memory space. In addition, as you add labels and values to the VisiCalc "electronic worksheet," more memory is used.

The Cell Indicator

On the right side of the second line, the prompt line of the status area, is the cell indicator. This shows how many unused worksheet cells are available at any time for further entries. This number will vary depending on how much of the worksheet has been used, the memory requirement of each cell, the number of ROMs that are plugged into the computer, etc.

Worksheet Size

When VisiCalc is loaded into memory, the computer's CRT screen may be thought of as a *window* that looks on only a small portion of the worksheet.



Just how large is this worksheet? The columns are lettered A through Z, AA through AZ, and BA through BK, for a total of 63 columns. There are 254 rows, so that makes a total of 254 × 63 or 16,002 possible cells.

Memory bytes are used by cells at the rate of eight bytes per cell position. So if you create a large worksheet, but most of the sheet is blank, the blank cells will each use eight bytes of memory. Naturally,

as you write labels or values into a cell, more memory is used for each additional character. Also, VisiCalc consumes additional memory for overhead, depending primarily on the number of rows and columns in use.

Even though VisiCalc lets you scroll down to cell BK254, the sheet is not really this large, because of memory limitations. In fact, the worksheet is dynamically reconfigured; it grows to be the size and shape you need as you use it. You actually start with a 1 by 1 sheet, starting and ending at cell A1. Although you can move the cursor to any cell out to BK254, no memory is actually allocated for the sheet until you write something on it. Then the sheet grows into a rectangle just large enough to include the highest-numbered rows and columns (that is, the bottom and furthest-right cells) in which something is written. As you move further down and to the right, writing labels, numbers and formulas, this process continues until the available memory is exhausted.

If you begin with a blank worksheet, then write a number or letter at cell BK1, the sheet grows to a size of 1 row by 63 columns. If you then move the cell cursor to any cell in row 254 and try to write there, the entry will not be accepted because you are attempting to extend the worksheet to a rectangle of 254 rows by 63 columns, and there is not enough memory available in your personal computer (unless memory modules are installed).

It is possible to add up to four memory modules of size 32K, 64K, or 128K to the computer. The maximum available plug-in memory could be up to $4 \times 128K = 512K = 524{,}288$ bytes. This is enough to handle even the largest worksheet. But a situation where this much memory is needed is the exception, rather than the rule.

The cell indicator will show the decrease in available memory as you write information on the sheet, or as you use commands which write on the worksheet. If you exhaust all of the available memory, VisiCalc will beep at you and refuse to write anything more on the sheet, as it will if you try to write at cell BK254 with insufficient memory.

In practice, you don't need to worry about memory. VisiCalc manages memory efficiently and automatically. Because memory is dynamically allocated and the sheet is reconfigured to suit your needs, you can, for all practical purposes, work on a sheet that is much larger than you could actually fit into the computer's memory. Aside from noticing from time to time how much space is still available for you to fill additional cells, you need not concern yourself with problems of memory management.

Shrinking the Worksheet

One thing VisiCalc does not do automatically, however, is "shrink" the worksheet. Suppose that you have written on various portions of the sheet, causing it to grow to a size of 50 by 50 cells. Later, having finished with this information, you might have erased or blanked out the cells near the right and bottom edges of the 50 by 50 sheet. The sheet will remain configured as 50 by 50, although each empty cell will require only two bytes. If you begin using additional memory by writing lengthy labels and formulas in other cell positions, you may want to shrink the sheet to the smallest possible configuration for the

information still written on it. To do this, you must save the sheet on disc with the /SS command, clear the sheet with /CY, and reload the saved sheet with the /SL command (/SS and /SL are discussed in section 2). As the file is loaded, VisiCalc will enter onto the sheet only those labels, numbers and formulas actually saved, and in the process the new sheet will grow from a 1 by 1 configuration to just the size you need for the information remaining. This will make more memory space available for additional labels and formulas.

Section 9

Printed Output

This section outlines the procedures for obtaining printed output of the VisiCalc worksheet and data from an optional peripheral device such as the HP 82905B Printer.

Using the Print Command

The /P (*print*) command allows you to print an entire VisiCalc worksheet, or specific portions of a worksheet. A special print command permits you to store the worksheet data on a disc as multiple strings of text, exactly as it appears on a printer. This data file may then be accessed by a BASIC graphics program or by a program designed to read the file and convert the strings of text to individual data items. Details of this are discussed at the end of section 2 and in section 10.

To print all or a portion of the VisiCalc worksheet:

1. Set the cell cursor to the upper left cell of the area of the worksheet to be printed.
2. Type /P. The prompt line displays `Printer:Current New Data File.`
3. Answer the prompt by typing C, N, or D.

Note: For the /PC and /PN commands an external printer *must* be attached to the computer. The CRT cannot be declared as the printer for these commands.

/PC *Current.* The prompt line displays `Print: Lower right cell.` Directs the program to print output on the currently specified printer. Your response is to type the coordinates of the lower right cell you want on the printout.

/PN *New.* The prompt line displays `Printer select code.` Allows a new printer select code to be entered. (The printer select code may also be entered before you load the VisiCalc program by using the PRINTER IS command from the keyboard.) To use the current select code press (END LINE).

An example of a printer select code is 701 (a typical external printer). After the printer select code is entered, the prompt line displays `Column width.` Your response is to type the number of print columns you want, followed by (END LINE).

The number of print columns needed is the product of your column width and the number of columns to be printed. If this number is greater than the column width on your printer (the HP 82905B has a maximum line length of 80 characters), the lines (worksheet rows) will "wrap-around." That is, all characters which exceed the maximum line length of your printer will be

printed on the next line. So you may want to print your worksheet in sections of 80 characters or less and then tape the sections together to obtain the proper worksheet structure.

Example. There is an /SS file on your VisiCalc PLUS disc called XYZ. This file has a column width greater than 80 characters, so if it were loaded onto the worksheet (loading is explained in section 2) and some of the rows printed with /PN (out to column M), the result would be:

```
COSTS AND EXPENSES:

  COST OF GOODS SOLD      123   130   176   225   260   275   308   416
528   605

  RESEARCH & DEVELOP       19    26    34    35    41    50    62    72
 86    93

  MARKETING & SALES        42    49    64    80    97    95   110   136
172   198

  GENERAL & ADMIN          33    35    49    56    71    67    89   102
129   163
```

/PD *Data file.* The prompt line displays `Print: Lower right cell.` Allows all or a portion of the worksheet to be stored on the current mass storage unit as a multiple string data file, exactly as it would be printed on a printer. Allows you to extract and store worksheet data for later retrieval and processing by a BASIC graphics program or a simple BASIC program that can read the data file as multiple strings. Data will be stored beginning with the location of the cell cursor at the time /P was selected.

Your response is to enter the coordinates of the lower right cell of the data to be stored.

The prompt line then displays `Print: File name.`

Enter the file name or use (END LINE) to print the file name directory. See sections 2 and 10 of this manual for details of the /PD command.

Unlike a storage command, /PD is a print command, and stores *only* what would be visible in a cell when the CRT "window" displayed it. Thus, even though an internal label might be RETAILING CENSUS, if the cell width were set to seven characters, only the label RETAILI would be stored by /PD.

CAUTION

The file created by the /PD command is for use with an external plotter or printer. Attempting to reload a /PD file by using the /SL command will produce unpredictable results.

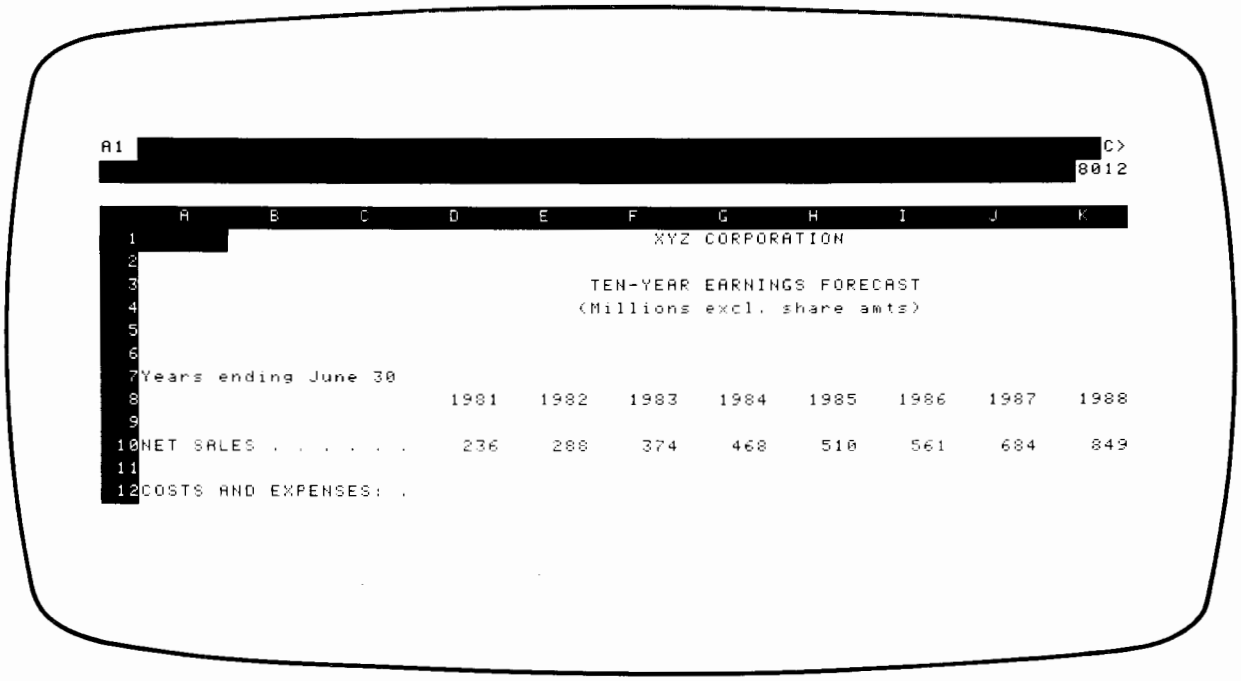
When you use the /P command, the VisiCalc status area and the specifiers for columns and rows that you see in the CRT display window are *not* printed. So if you want your printed output to be labeled and titled, you must set up a system of labels and titles on the worksheet.

Pressing the (PAUSE) key halts printing and returns VisiCalc to top-level mode.

Example. Let's use the print commands to copy part of a worksheet to a peripheral printer. First, make sure your printer is properly connected to the computer. We will use the worksheet of the mythical XYZ corporation which is available on your VisiCalc PLUS disc:

Press /CY /SL XYZ (END LINE)

VisiCalc Worksheet

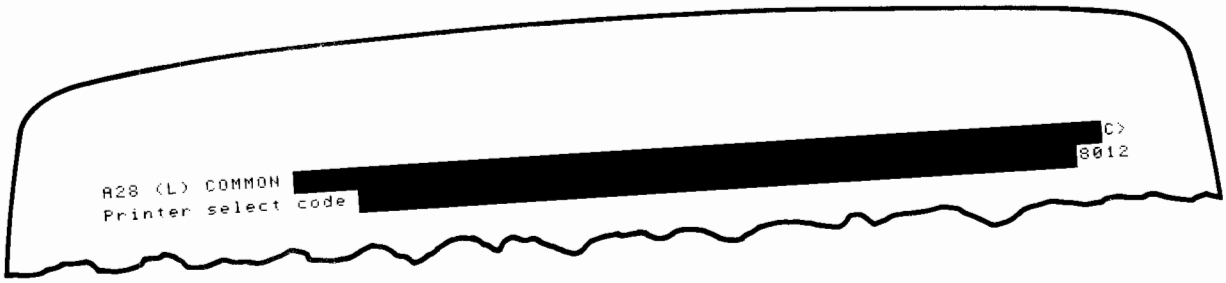


The /SL (*load*) command loads the worksheet from the disc. This command is explained in detail in section 2. There will be a momentary delay while the worksheet is being loaded.

Now we set the cell cursor to the top left-hand cell of the rectangular area we want printed. We will choose a small section in the lower left-hand corner:

Press (>) A28 (END LINE) /PN

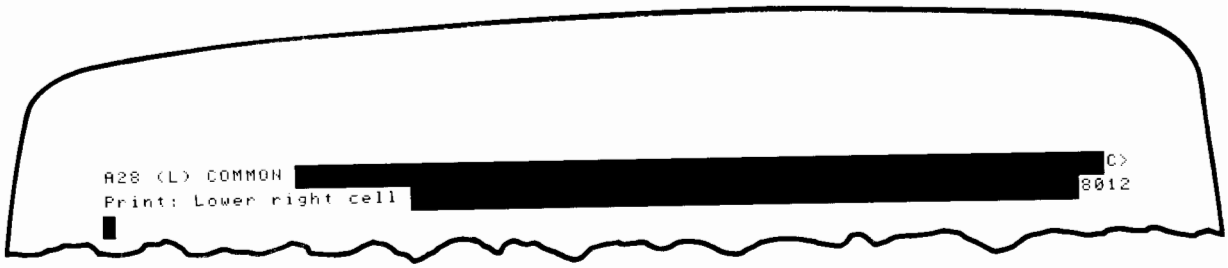
VisiCalc Status Area



VisiCalc now needs to know the Printer select code. Enter the code for your printer and press (END LINE). Your computer now asks for the Column width. For an HP 82905B the column width is 80, so:

Press 80 (END LINE)

VisiCalc Status Area



Now Press G35 (END LINE)

VisiCalc Printed Output

COMMON SHARES, YR END	62	63	66	68
PER SHARE:				
NET EARNINGS . . .	0.16	0.40	0.43	0.57
CASH DIVIDENDS . .	0.02	0.05	0.05	0.05
TOTAL DIVIDENDS . . .	1	3	3	3
RETAINED EARNINGS . .	9	22	25	36

Since we have just designated the peripheral device where printed output is to be sent, the next time we want a printout we can use the /PC (*print to current device*) command.

Using a Peripheral Printer

With VisiCalc and the Series 80 Personal Computer, you can use any peripheral printer that is compatible with the HP-IB (Hewlett-Packard-Interface Bus), HP 82939A Serial Interface module, or HP 82940A GPIO Interface module. You can specify the worksheet column width using the /GC command. And you can also specify printed column width using the /P command.

It is possible to increase the number of characters printed per line on many HP printers. The HP 82905B printer can print up to 132 characters per line. This is accomplished by sending an escape sequence to the printer as the first characters to be printed. The escape sequence does not cause anything to be printed, but it changes the number and/or size of letters to be printed per line. In order to send the escape sequence to the printer you could place it in the first worksheet cell to be printed, and then use the /PN or /PC command. The escape sequence should look like a label to VisiCalc, so precede it with a quote.

For example, to print 132 characters per line on an HP 82905B Printer, place the cell cursor to the cell just ahead of your first worksheet cell which contains actual data, and press ' CTRL SHIFT [&k2S. (Don't forget to execute a /PN or /PC command in order to define a column width of 132.) If you want to switch back to 80 characters per line, you could go to your leading cell and press ' CTRL SHIFT [&k0S, and then "print" this escape sequence with /PN or /PC. Other escape sequences are available for various types of printing styles. Refer to the owner's manual for your printer for its set of escape sequences. Note that CTRL [serves for the escape character in VisiCalc.

Before attempting to print to a peripheral printer, make sure that the printer is properly connected to the computer and is on line. Consult the printer manual for user instructions.

VisiCalc PLUS: Graphing With VisiCalc

This section explains how to use the /PD command to store a file on a disc. It also explains how to use the file stored by /PD and one of the four BASIC graphics programs to create graphs which represent the VisiCalc data.

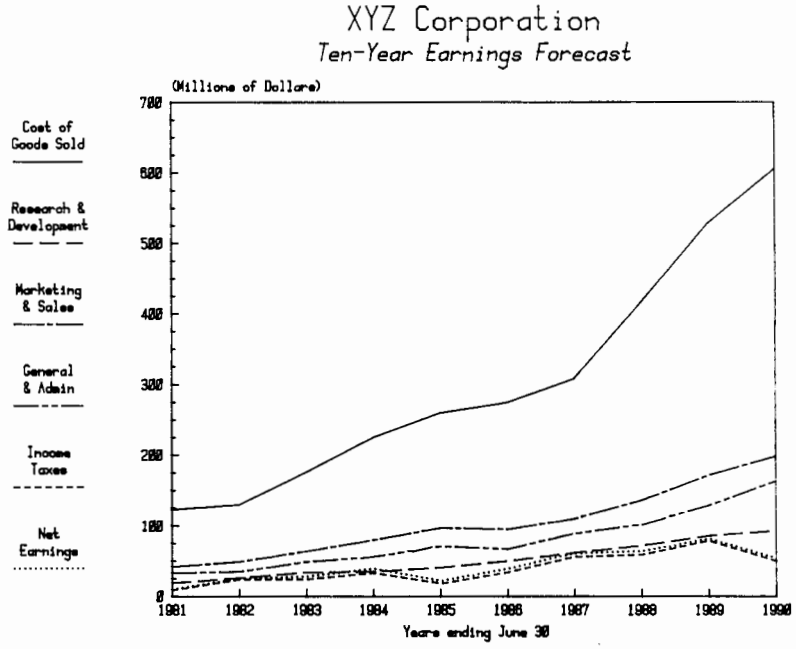
In addition to the programs on the VisiCalc PLUS disc, you will need the following items to create graphs from VisiCalc data:

- HP-86/87 Personal Computer with disc drive attached.
- At least one 32K, 64K, or 128K memory module for the HP-86/87.
- A plotter, such as the HP 7225, HP 7470, or HP 9872 and its interface cable and a Plotter ROM, if you plan to do peripheral plotting. You can display your graphics output on the CRT screen if you don't have a plotter.

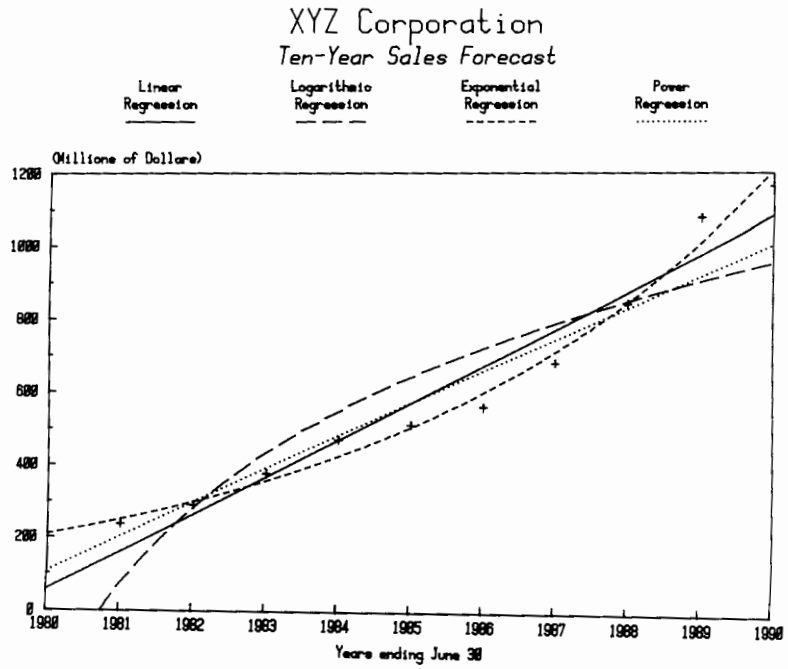
The Graphics Programs

Four graphics programs are on the VisiCalc PLUS disc in addition to the VisiCalc program. These programs are VZLINE, VZCURV, VZPIE, and VZBAR, and they generate the following types of plots:

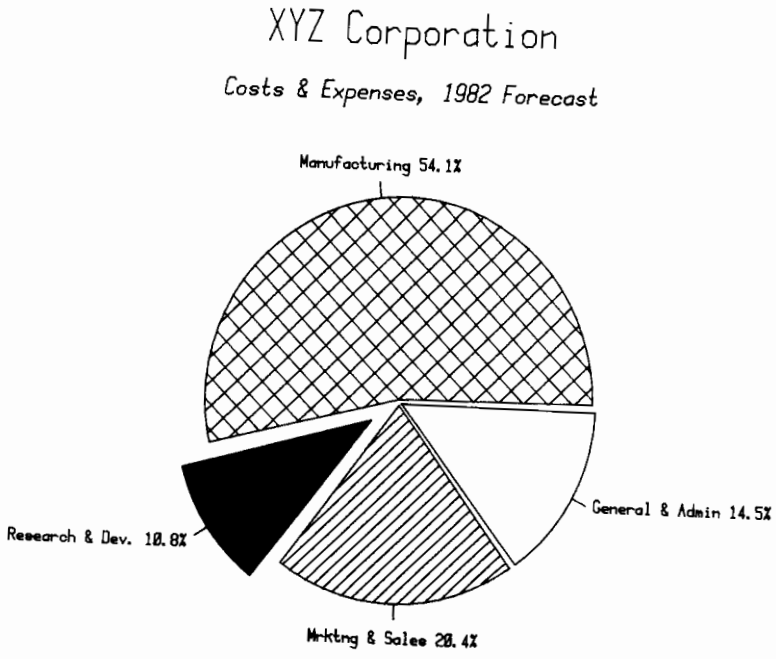
Line Charts: VZLINE produces line charts which may be linear, logarithmic, or semi-logarithmic. You can plot as many as six lines per chart, and each line can be plotted from up to 150 data points.



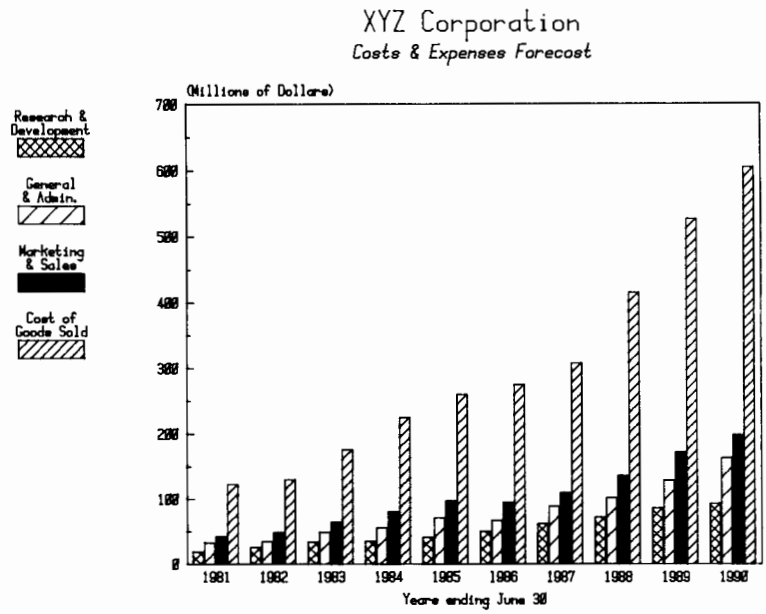
Curve Fitting: VZCURV plots up to 250 data points and permits you to fit up to four standard curves to the points. The standard curves are linear, logarithmic, exponential, and power.



Pie Charts: VZPIE plots one or two pies on a single chart. Each pie consists of from two to 25 slices, and you can specify any slice as either normal or exploded from the rest of the pie. Pie charts also have six shading (hatching) options.



Bar Charts: VZBAR plots normal, stacked or clustered bars, according to your needs. Up to 25 normal bars, stacks or clusters can be drawn on a single plot. Each stack or cluster may contain up to six bars. Like pie charts, bar charts have six shading (hatching) options.



All plots can use up to eight pen colors, and all programs permit you to write chart titles in upper- and lower-case, upright and slanted characters. Titles are automatically centered by each PLUS program.

Preparing VisiCalc Data for Graphing

To plot data, each of the four graphics programs requires that your VisiCalc data first be arranged in a special format and stored on disc with the /PD command. Then, each graphics program can load and use data from the special type of file that has been created for it.

Each of the four VisiCalc PLUS graphics programs can use data from only two kinds of files:

1. *VisiCalc (/PD) Data File*: A file created with data arranged in a specific format. There are three types of file formats, one of which can be used to plot with either VZLINE or VZCURV.
2. *Converted VisiCalc Data File*: A special file stored by the graphics program itself. A converted VisiCalc data file contains not only data (often from several /PD files), but also all graphing information, including titles, labels, pen colors, axes, etc. Each file is usable only by the VisiCalc PLUS graphics program which created it. (The converted VisiCalc data files created by VZLINE and VZCURV are not interchangeable.)

Refer to the user instructions in this section for a specific program to determine the /PD VisiCalc data file format you will need. Short descriptions of each of the three file formats are:

1. VZLINE and VZCURV: Two adjacent rows or columns of (x,y) data points.
2. VZPIE: Two adjacent rows or columns. The first row or column must contain labels for the pie slices; the second must contain data for the pie slices.
3. VZBAR: A single row or column of up to 25 numbers. If you wish to create a stacked or clustered bar graph, you may have up to six of these files, all in the same format.

Using the /PD Command

The /PD (*print to data file*) command is a special print command in the VisiCalc program that stores data as a series of ASCII strings on a disc. In VisiCalc, these strings are usable only by the VisiCalc PLUS graphics programs. If you attempt to load a /PD file back onto your VisiCalc worksheet, unpredictable results will occur. (You can use a simple BASIC program to extract data from a /PD file. Refer to Reading /SS and /PD Data Files in section 2 of this manual.)

Since using the /PD command for graphics may require that you rearrange your worksheet, you may want to save the original sheet and its data in a file with the /SS command before proceeding.

To use the /PD command:

1. Set up the data on the VisiCalc worksheet in the specific format required by the individual graphics program you are going to run (VZLINE, VZCURV, VZPIE, or VZBAR). Use /M (*move*) and other editing commands to assemble the data you need.
2. Ensure that a disc is installed in the disc drive.
3. Set the cell cursor to the upper left-hand cell whose contents are to be stored.
4. Type /PD. The prompt line displays `Print: Lower right cell.`
5. Enter the coordinates of the lower right cell whose contents are to be stored, then press END LINE.
6. When the lower right cell has been entered, the prompt line displays `Print: File name.`
7. You now have the option to press END LINE to generate a listing of files already on the disc onto the current PRINTER IS device.
8. Type the new file name, then press END LINE.

Example. Here is a portion of a ten year forecast for the XYZ Corporation. (This data is available on your VisiCalc PLUS disc, in the file named XYZ. The XYZ file was created with the /SS command, so you can load the file by using /SL.)

XYZ CORPORATION

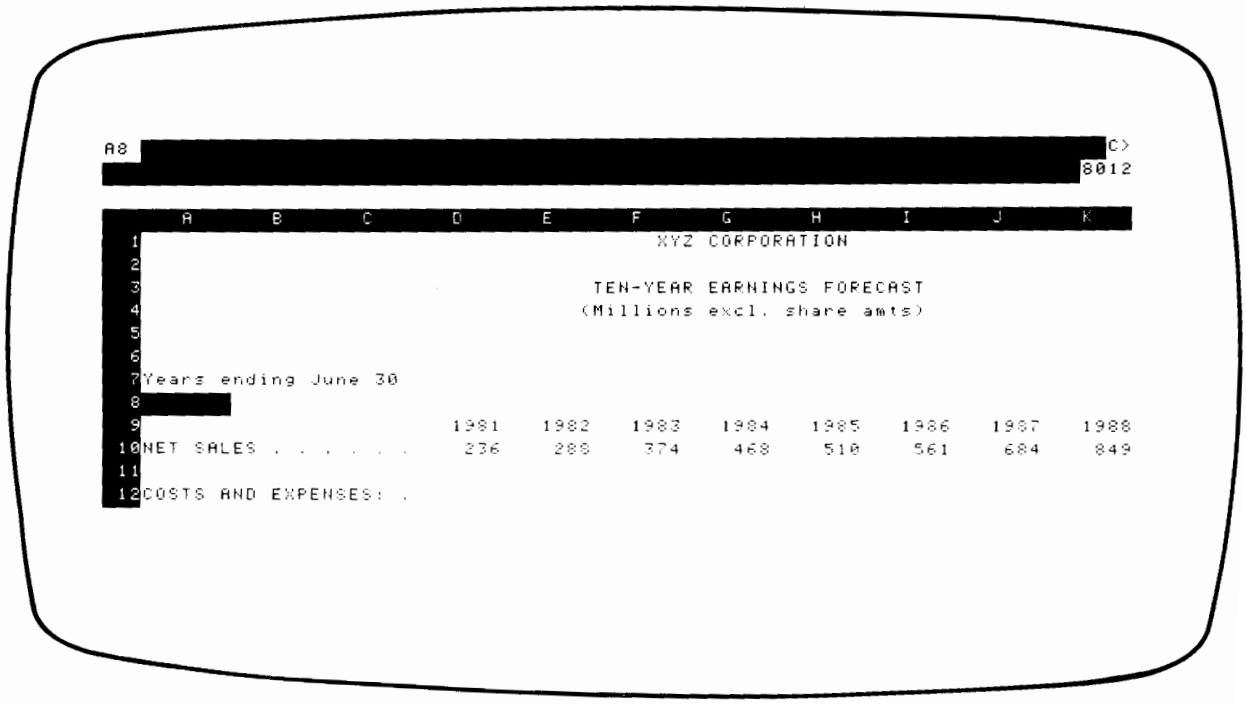
TEN-YEAR EARNINGS FORECAST
(Millions excl. share amts)

Years ending June 30	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
NET SALES	236	288	374	468	510	561	684	849	1078	1164
COSTS AND EXPENSES: .										
COST OF GOODS SOLD	123	130	176	225	260	275	308	416	528	605
RESEARCH & DEVELOP	19	26	34	35	41	50	62	72	86	93
MARKETING & SALES	42	49	64	80	97	95	110	136	172	198
GENERAL & ADMIN .	33	35	49	56	71	67	89	102	129	163
TOTAL	217	239	322	395	469	488	568	726	916	1059
EARNINGS BEFORE TAXES	19	49	52	73	41	73	116	123	162	105
TAXES ON INCOME . . .	9	24	24	33	18	34	56	59	79	50
NET EARNINGS	10	25	28	39	22	39	61	64	82	54
COMMON SHARES, YR END	62	63	66	68	70	73	76	79	82	83
PER SHARE:										
NET EARNINGS . . .	0.16	0.40	0.43	0.57	0.32	0.54	0.80	0.81	1.01	0.66
CASH DIVIDENDS . .	0.02	0.05	0.05	0.05	0.05	0.06	0.10	0.10	0.12	0.08
TOTAL DIVIDENDS . . .	1	3	3	3	4	4	8	8	10	7
RETAINED EARNINGS . .	9	22	25	36	19	35	53	56	73	48

To store the *net sales* and the *year* data as two rows of (x,y) data points (the format required by the VZLINE and VZCURV programs), first load the XYZ file using /SL. Then arrange the data as shown. You can use the *move* command to set the years row and the *net sales* row to be adjacent:

Press /CY /SL XYZ END LINE > A8 END LINE /M . A10 END LINE

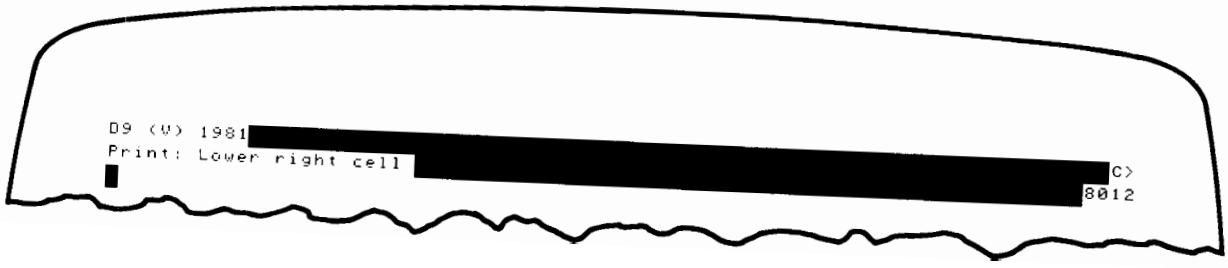
VisiCalc Display



Install the disc on which the data should be recorded. Set the cell cursor to the upper left-hand cell you want to store, then press /PD:

Press > D9 END LINE /PD

VisiCalc Status Area

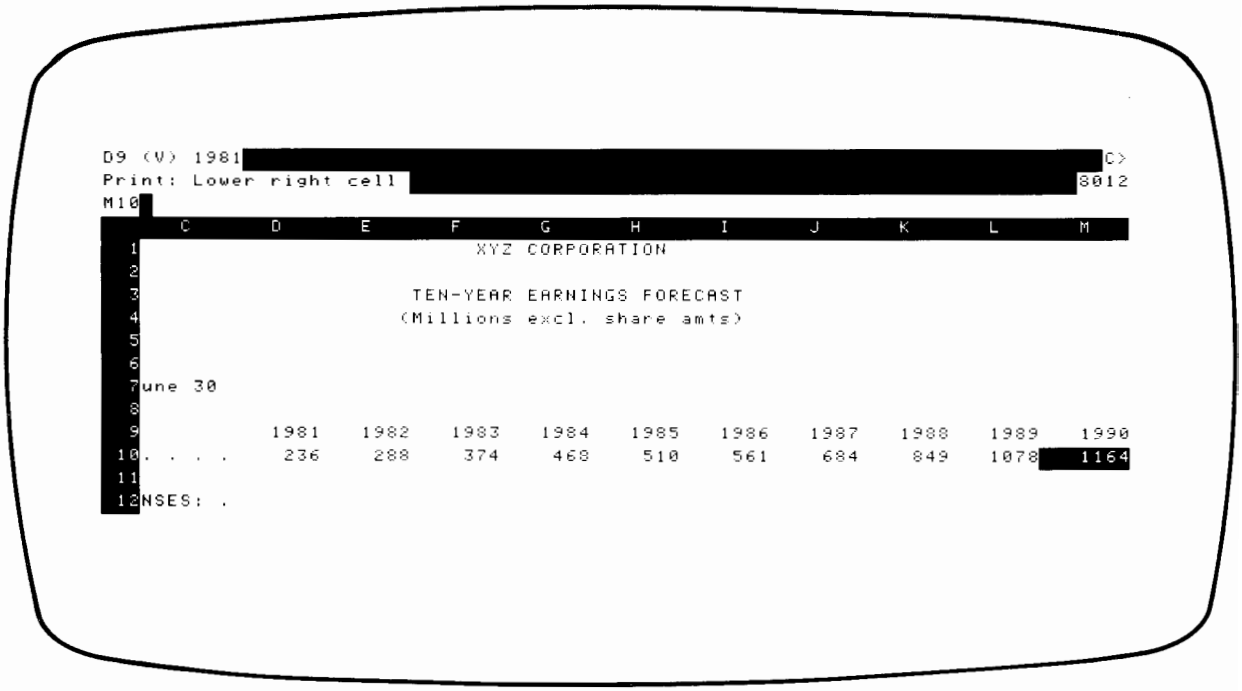


Now move the cursor out to cell M10 to enter the coordinates for the lower right-hand cell of the data you want to store:

Press ↓

Then Press and Hold →

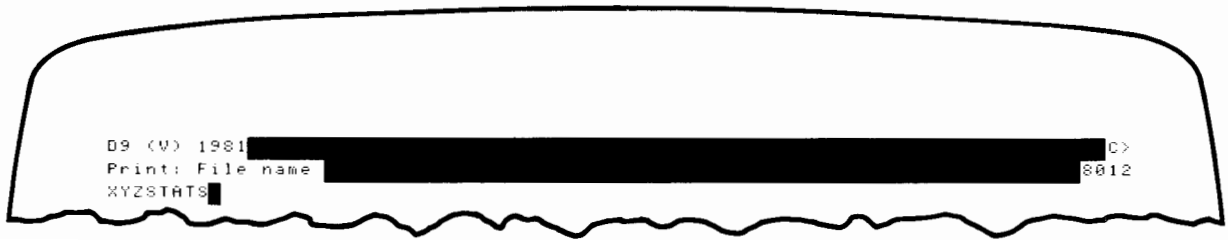
VisiCalc Display



Now press END LINE, then assign the file a name. You can help identify the file later by naming it with a meaningful code. For example:

Press END LINE XYZSTATS

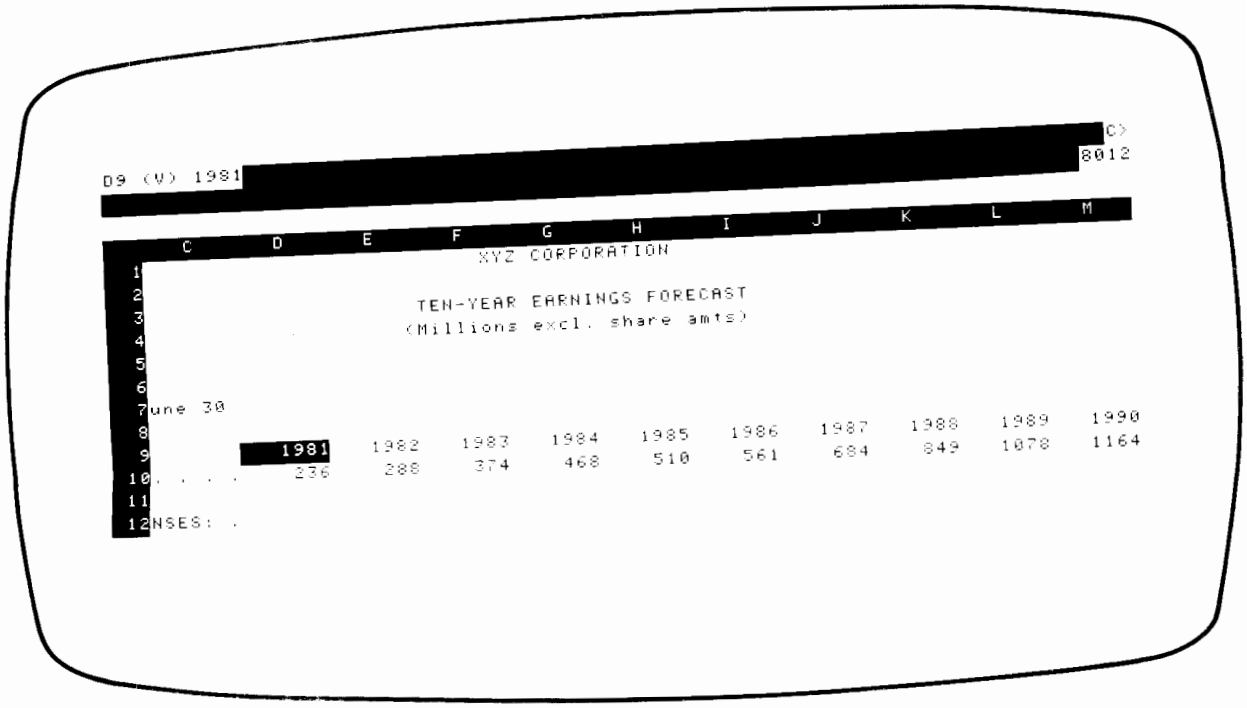
VisiCalc Status Area



When you press (END LINE) now, the data is stored on the disc, ready for access by the line plotting (VZLINE) or the curve fitting (VZCURV) program.

Press (END LINE)

VisiCalc Display



Note: When arranging data on the worksheet to be stored by the /PD command, you should use the editing commands (move, delete, and insert) with caution. Blank rows/columns may be deleted, because no formulas depend on their entries. However, avoid deleting non-blank rows/columns, as their values may be referenced by other cells. For example, on the XYZ worksheet, the *net sales* row should never be deleted, because the entries in the *cost of goods sold* row depend on *net sales*.

Switching Between VisiCalc and Graphics Programs

The VisiCalc program itself is a binary program that you load by typing LOADBIN "VZCALC" (END LINE). The PLUS portion of VisiCalc PLUS, the four graphics programs, consists of BASIC programs that are loaded by the LOAD command. In turn, the PLUS programs load and execute a binary program called LINCURg. (You never have to worry about this program; it is loaded automatically by the graphics programs.) REDZERg is another binary program that is loaded at the same time as LINCURg, but is not needed with VZPIE. VisiCalc and the PLUS programs cannot be run at the same time on the computer, so you must use the (RESET) key to halt the execution of the VisiCalc program before loading one of the PLUS programs. To go from a PLUS program back to VisiCalc, you must use SCRATCH (END LINE) and LOADBIN "VZCALC" (END LINE).

To switch from the VisiCalc program to one of the graphics programs:

1. Save the VisiCalc worksheet and data with the /SS command before proceeding, if you wish to reuse it.
2. Press (RESET). VisiCalc returns `Reset: Y to confirm.`
3. Enter Y to confirm that you want to reset.
4. Press LOAD followed by the name of the desired graphics program (e.g., LOAD "VZLINE"). Then press (END LINE).

To switch between graphics programs, simply load the new graphics program.

Running the PLUS Programs

To run one of the VisiCalc PLUS graphics programs, just turn to the part of this section that details its operation, then follow the instructions. Each graphics program prompts you for all inputs as they are needed.

When a PLUS program prompts you for input, usually one of the options is highlighted. This means it is the *default* (assumed) option, and to select it just press (END LINE).

Whenever a PLUS program prompts you for a file name, you have the option of appending the file name with a colon (:) and a mass storage unit specifier (msus). This can be useful when running VisiCalc PLUS on a system with more than one disc drive. In particular, it is convenient to refer all requests for data to one disc, while the VisiCalc PLUS programs themselves are kept separately on another disc. Example: FILEONE:D701.

All graphics programs allow you to generate a small plot on the computer's CRT screen (no peripheral plotter need be attached), as well as allowing for a full plot on a peripheral device. Each graphics program allows you to title the entire chart and to label axes, legends, pie slices, etc. You also are given various editing options by each program.

Each of the programs makes use of the special function keys (k1-k14). One of these keys is always designated the HELP key; it generates a full description of the key functions for you.

Line Charts

The VZLINE program permits the data in up to six VisiCalc data files, or a single converted VisiCalc data file, to be used to create a graph of from one to six lines. A converted VisiCalc data file is a file that has been stored from the VZLINE program and which contains all graphing information in addition to data. From a single VisiCalc data file, one line may be graphed; from two files, two lines may be graphed along the same axes, etc. Each line may be plotted using up to 150 (x,y) data points.

The graph can be linear, logarithmic, or semi-logarithmic, and you can plot a chart title and subtitle in addition to the X- and Y-axes titles. You can specify both labeled major units of measure and unlabeled tics along the axes, and an additional option permits you to plot a grid on the graph. A special feature allows X-axis units of quarters, months or days (years are treated as numeric data).

To use the program, you must know the values of the data; a special option permits review of the raw data in the /PD VisiCalc data file.

File Format for Line Charts

In order to use VZLINE, each VisiCalc data file you create with the /PD command *must contain the (x,y)* data points arranged in two adjacent rows or two adjacent columns. The data file may contain only values; labels and blank cells are not allowed. If X-axis data is expressed in days, months or quarters, it must be converted to equivalent values (e.g., SUNDAY = 1, MONDAY = 2; or JAN = 1, FEB = 2, etc.) on the VisiCalc worksheet.

User Instructions for Line Charts

To load the line chart program, insert the VisiCalc PLUS disc into the disc drive and type LOAD "VZLINE" (END LINE).

To run the program, press (RUN). LINCURg and REDZERg will be loaded automatically by VZLINE, and you will be asked to specify a printer device number. This will determine where your printed output will go throughout the VZLINE program.

Make sure a suitable VisiCalc data file (/PD file) is available for each line, or that a converted VisiCalc data file is available on a disc.

Whenever VZLINE prompts you for a file name, you can first press (END LINE) to generate a directory of the files on the disc. The directory is routed to the current PRINTER IS device.

Data File Selection—VZLINE prompts `Select type: (V/C) ?` to ask for the type of data file.

If your file is a converted VisiCalc data file—enter C (END LINE). VZLINE prompts `Enter file name: -OR- Press [END LINE] for catalog` so that is can find your file. You now have the option of pressing (END LINE) to get a listing of all files on the disc. After you have taken or declined this option you must enter the file name, followed by (END LINE). Continue with *Primary Select Options.*

If your file is a /PD file—enter V (END LINE). VZLINE prompts `Number of lines to be graphed: (1-6) ?`. A separate VisiCalc data file (/PD file) must exist for each line. Enter the number of lines (files), press (END LINE) and continue.

Data Set-Up—When `Enter file name for line #` (line number) `-OR- Press [END LINE] for catalog` is displayed, you again have the (END LINE) option to see the file directory. After this option, enter the name of the file with the data ((x,y) coordinates) for the present line, and press (END LINE).

You can review the data on the /PD file, to help answer the prompts you will receive on file format, X-axis and Y-axis scaling, line legends and labels. When `Review data: ... Select: (P/D/N)` is displayed you can press P (END LINE) to print the file, or you can press D (END LINE) to display the file, or you can press (END LINE) to continue without reviewing the data. If you choose to review the data you must then press (CONT) to continue.

When you see `File format: 2 Rows or 2 Columns (R/C)?`, you should press R (END LINE) if your data points are arranged in 2 rows. If you data points are in 2 columns, press C (END LINE).

If your data is in two rows—VZLINE prompts `X-axis row: (Upper or Lower) ?`. You should press L (END LINE) if the lower row in your file contains the X-coordinates. If the upper row has the X-coordinates, press (END LINE).

If your data is in two columns—VZLINE prompts `X-axis column: (Left or Right) ?`. You should press R (END LINE) if the right-hand column in your file contains the X-coordinates. If the left-hand column has the X-coordinates, press (END LINE).

Line Legends—VZLINE prompts `Legend for Line #` (line number) `: (FIRST 12 characters) ?` to ask you for the first part of a line legend. If you don't want a line legend, just press (END LINE).

> Note: If a legend for the line has already been entered and is now being edited, the original legend appears with the cursor beneath the prompt. You can enter a new legend, alter the original legend, or leave the original unchanged.

If you want a line legend, enter it (up to 12 characters) and press (END LINE); VZLINE will then prompt `Slanted label: (Y/N) ?` and allow you to declare a plain label (upright) with (END LINE) or a slanted one with Y (END LINE).

> Note: If a legend for the line has already been entered, a Y or N for slanted legend appears with the cursor. You can change the Y or N for the legend or you can leave it unchanged.

Now VZLINE displays `Legend for Line #` (line number) `: (LAST 12 characters) ?`. If the second part of the line legend is not needed, just press (END LINE).

If you want the line legend to have a second part, enter it (again, 12 characters or less) and press (END LINE); VZLINE will again prompt `Slanted label: (Y/N) ?` and allow you the choice of a plain label (press (END LINE)) or a slanted one (press Y (END LINE)).

Pen Color—The display now reads `Select pen color: ... Enter 1-8?`. Enter 1 (black), 2 (red), 3 (blue), 4 (green), 5 (lime), 6 (gold), 7 (orange), or 8 (brown) to select the color of ink for this line. Then press (END LINE).

If *Pen Color* is adjusted as an editing option, follow *Edit Select Options.*

If there are more lines (files) to be prepared, repeat *Data Set-Up* for each one.

Axes Set-Up—When `X-axis type: (LINear/LOG) ?` is displayed, press (END LINE) to set the X-axis on a linear scale, or type LOG (END LINE) to make a logarithmic X-axis scale. VZLINE will now prompt `Y-axis type: (LINear/LOG) ?` and give you the same choice for the Y-axis.

After you have entered the Y-axis scale, VZLINE prompts `Grid: (Y/N) ?`. Press (END LINE) for a normal plot, or Y (END LINE) for one with a grid.

Now VZLINE prompts `X-axis units: ... Enter (Q/M/D/N) ?` for units of measure along the X-axis. Permissible units are either in terms of time (quarters, months, or days) or numeric units. If a logarithmically-scaled X-axis has been selected, it will be changed to a linear one if quarters, months, or days are selected here.

If you want numeric units (including years)—type (END LINE). VZLINE must know the `Minimum X-axis value ?` since you are using a strictly numeric axis. Enter the smallest X value and press (END LINE). VZLINE then needs to know the `Maximum X-axis value ?` so that it can set the other end of the scale. Enter the largest X value and press (END LINE). Continue with *Axes Dimensions.*

If you want quarters—press Q (END LINE). VZLINE will now ask for the `First Quarter Number: (1 = 1st, 2 = 2nd, ... etc.)`, and then for the `Last Quarter Number: (4 = 4th, 5 = 1st, 6 = 2nd ... etc.)`. Enter 1, 5, 9, etc. for the first quarter, or 2, 6, 10, etc. for the second, and so on. then press (END LINE) and continue with *Axes Dimensions* after both prompts have been answered.

If you want months—press M (END LINE). VZLINE will now ask for the `First Month Number: (1 = JAN, 2 = FEB, 3 = MAR ... etc.)`, and then for the `Last Month Number: (12 = DEC, 13 = JAN, 14 = FEB ... etc.)`. Enter 1, 13, 25, etc. for January, or 2, 14, 26, etc. for February, and so on. Then press (END LINE) and continue with *Axes Dimensions* after both prompts are answered.

If you want days—press D (END LINE). The two prompts you will now see are `First Day Number: (1 = SUN, 2 = MON, 3 = TUE ... etc.)` and then `Last Day Number: (7 = SAT, 8 = SUN, 9 = MON ... etc.)`. Enter 1, 8, 15, etc. for Sunday, or 2, 9, 16, etc. for Monday, and so on. Then press (END LINE) and continue with *Axes Dimensions* after both prompts have been answered.

Axes Dimensions—Now VZLINE wants to know the `Number of units between X-axis labels ?`, and then the `Number of units between X-axis tics ?`. For each of these successive prompts enter the value (distance) you want between each label or tic on the X-axis, followed by (END LINE).

When `Minimum Y-axis value ?` is displayed, enter the smallest Y-coordinate value to be graphed, followed by (END LINE). Do the same for the largest Y-coordinate value to be graphed when `Maximum Y-axis value ?` is displayed.

Now, VZLINE will prompt successively for `Number of units between Y-axis labels ?` and `Number of units between Y-axis tics ?`. Handle these the same as you did the X-axis labels and tics.

If *Axes Dimensions* are adjusted as an editing option, follow *Edit Select Options.*

Chart Titles—`Enter chart title ( 32 character maximum) ?` is now displayed. If you do not need a main title, press (END LINE).

If you need a main title, enter it (1-32 characters), followed by (END LINE). VZLINE prompts `Slanted label: (Y/N) ?` and accepts either a Y (END LINE) response for a slanted label, or an (END LINE) response for a plain one.

When you see `Enter chart subtitle ( 32 character maximum) ?` VZLINE is ready for you to enter the chart's subtitle. If no subtitle is desired respond with (END LINE) without entering a label.

If you want a subtitle, enter it, followed by (END LINE). After this, VZLINE will give you the same slanted label option.

VZLINE will now prompt you with `Enter X-axis title ( 32 character maximum) ?`, and later with `Enter Y-axis title ( 32 character maximum) ?`. Both of these labels can be from 1 to 32 characters long, either or both can be slanted (you will receive the familiar "slant" prompt for each). Either or both can also be blanked (no label printed) by pressing (END LINE) without entering a label.

If *Chart Titles* are adjusted as an editing option, follow *Edit Select Options.*

Primary Select Options—`Select Option` is displayed and the special function keys (k1-k14) are labeled:

VZLINE is now waiting for you to declare the next task to be accomplished. Here are short descriptions of the key functions: key #1, PLOTTER, plots the graph on a peripheral plotter; key #2, SAVE DATA, creates a converted VisiCalc data file from the current data, so that it can be easily replotted; key #3, GET DATA, helps you load a VisiCalc data file or a converted VisiCalc data file and re-execute VZLINE to plot the new data; key #4, LIST, lists all data, titles, labels, etc. of the set of lines; key #5, EDIT, lets you edit data, titles, legends, axes specifications and pen color; key #6, HELP, displays more complete descriptions of these key functions; key #7, EXIT, ends the VZLINE program and returns the computer to calculator mode; and key #8, CRT PLOT, returns an abbreviated plot on the CRT screen.

Once you have decided on your next course of action, press that key and continue with the paragraph labeled with that key's name.

Key #1, PLOTTER —Select type of plotter: ... Enter (1-3) ? requires a response of 1 (END LINE) if the HP 7225 plotter is being used, or a response of 2 (END LINE) if the HP 7470 is in use, or a response of 3 (END LINE) if your plotter is the HP 9872. If your plotter is an HP 9872, VZLINE will now prompt you for the number of pens your version uses.

When Enter plotter address or press [END LINE] for AUTO-SCAN ? is displayed, enter the plotter address and press (END LINE). (Refer to the plotter user's manual for its address. A typical peripheral plotter address is 705.)

If you don't know or aren't sure of the address, press (END LINE) instead and the computer will try to find the plotter. If the plotter cannot be found, continue these directions with *Primary Select Options.*

When Prepare the plotter and press [CONT] is displayed, ensure that paper is in the plotter; then press (CONT) and continue with the directions for key #8, CRT PLOT.

Key #2, SAVE DATA —VZLINE asks you to Enter file name: -OR- Press [END LINE] for catalog. If you want a catalog of files on the disc, press (END LINE) first. (This may be a good idea, to keep you from accidentally duplicating a file name.) Then enter the file name for the new converted VisiCalc data file you are creating, followed by (END LINE).

If you *do not* see the prompt File name (file name) already exists. Select option: (O/R/C), you can now go back to *Primary Select Options* to assign the next task. But if you do see it, you have duplicated a file name, and must continue.

You must do one of three things: enter O (END LINE) to overwrite the old file with the new data and continue with *Primary Select Options,* or enter R (END LINE) to rename the new file and repeat the directions for key #2, SAVE DATA, or enter C (END LINE) to cancel the store operation and continue with *Primary Select Options.*

Key #3, GET DATA —This will allow you to re-execute the VZLINE program with a new data file (or files). Continue with the directions for *Data File Selection.*

Key #4, LIST —The listing is routed to the current PRINTER IS device, so if it comes out on the wrong device you may want to (PAUSE) the VZLINE program, redefine PRINTER IS, restart VZLINE with (CONT), and re-execute this key function. Once the listing is complete you can return to *Primary Select Options* and choose another task.

Edit Select Options—Key #5, EDIT —You can now edit the graph before plotting. `Select option` is displayed and the keys are relabeled:

Key #1, DATA , lets you edit the (x,y) data to be used for graphing. When you see `Line number for data edit ?`, enter the line number (1-6) of the line of (x,y) data points you wish to edit, followed by (END LINE).

VZLINE then wants to know the `Data Point number for data edit ?`, which you should enter, followed by (END LINE). The program displays the line number, point number, and (x,y) coordinates.

Now you will see `X-coordinate, Y-coordinate:?` on one line and the (x,y) coordinates on the next with the cursor. You can press (END LINE) to proceed without editing, or enter the new data, followed by (END LINE). The X-coordinate is to the left of the comma, the Y-coordinate to the right.

VZLINE will ask `Edit another point: (Y/N) ?` . Enter (END LINE) and continue with *Edit Select Options* if you are through editing the data points.

If there are more points to edit, enter Y (END LINE) and repeat the directions for key #1, DATA .

Key #2, LEGENDS , lets you edit the line legends. For this, VZLINE needs the `Line number for new legend ?`. Enter the line number (1-6) followed by (END LINE), and continue with *Line Legends.*

Key #3, AXES , permits you to edit the units and scaling parameters used for the X- and Y-axes. Continue with the directions for *Axes Set-Up.*

Key #4, TITLES , is used to adjust the chart and axes titles. Continue with the directions for *Chart Titles.*

Key #5, PEN COLOR , displays `Line number for new pen color ?`. Respond with the number of the line (1-6) for which the pen color is to be changed, followed by (END LINE). Continue with the directions for *Pen Color.*

Key #6, HELP , displays more complete descriptions of the keys used in this step; continue with the directions for *Edit Select Options.*

Key #7, CONTINUE , cancels the editing option and returns you to the primary options; continue with the directions for *Primary Select Options.*

Key #6, HELP —displays descriptions of the functions of the special function keys and returns you to *Primary Select Options.*

Key #7, EXIT —This key will end the VZLINE program and return the computer to calculator mode. A special safety feature requires that you press Y (END LINE) to confirm that you want to end VZLINE, and prevents accidental exits.

Key #8, CRT PLOT —The program prompts for each line, giving the title and the number of (x,y) data points in the line. When First point to graph: (Default is point 1) ? is displayed, you can press (END LINE) to begin the graph with the first data point, or you can enter the number (1, 2, 3, etc.) of the first data point to be graphed, followed by (END LINE).

VZLINE then prompts for the Last point to graph: (Default is point (final point)) ?. Press (END LINE) to end the graph with the final point, or enter the final point number, followed by (END LINE).

If the first and last points of all lines have not been declared, these last two prompts will be repeated until they are. The graph will then be created.

When plotting is complete, press (CONT), and continue with *Primary Select Options.*

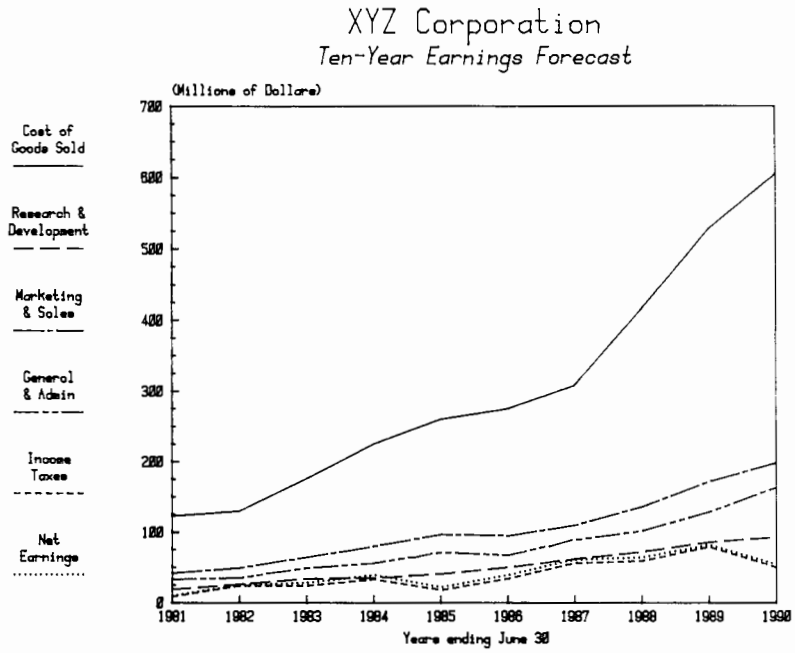
Example. Using the data shown here for the XYZ Corporation, plot the lines for projections of costs of goods sold, research & development, marketing & sales, general & admin., income taxes, and net earnings for the years 1981-1990. (You have created a /PD file for net sales if you worked the example under Using the /PD Command. The data itself is available on the file XYZ on the VisiCalc PLUS disc.)

XYZ CORPORATION

TEN-YEAR EARNINGS FORECAST
(Millions excl. share amts)

Years ending June 30	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
NET SALES	236	288	374	468	510	561	684	849	1078	1164
COSTS AND EXPENSES: .										
COST OF GOODS SOLD	123	130	176	225	260	275	308	416	528	605
RESEARCH & DEVELOP	19	26	34	35	41	50	62	72	86	93
MARKETING & SALES	42	49	64	80	97	95	110	136	172	198
GENERAL & ADMIN .	33	35	49	56	71	67	89	102	129	163
TOTAL	217	239	322	395	469	488	568	726	916	1059
EARNINGS BEFORE TAXES	19	49	52	73	41	73	116	123	162	105

TAXES ON INCOME . . .	9	24	24	33	18	34	56	59	79	50
NET EARNINGS	10	25	28	39	22	39	61	64	82	54



Curve Fitting

The VZCURV program permits the data in a single VisiCalc data file to be fitted to up to four standard curves:

- Straight line (linear regression); $y = a + bx$.
- Exponential curve; $y = ae^{bx}$ $(a > 0)$.
- Logarithmic curve; $y = a + b * \ln(x)$.
- Power curve; $y = ax^{b}$ $(a > 0)$.

The type of curve fit is specified after data is read from a VisiCalc data file or converted VisiCalc data file. Any curve can be specified by pressing the desired key.

The data is entered from either a VisiCalc data file (/PD file) or a converted VisiCalc data file on disc. A converted VisiCalc data file is a file that has been stored from the VZCURV program and which contains all graphing information in addition to data. The program is designed for a maximum of 250 data points. The data which has been entered can then be plotted, but not edited.

Once the curve fit has been selected, the regression values will be calculated. The coefficient of determination, r^2, indicates the accuracy of fit achieved by the regression. Values of r^2 close to 1.00 indicate a better fit than values close to zero. The regression coefficients, a and b, define the curve generated, according to the equations shown above.

After the analysis of variance has been calculated and printed, you can plot the regression curve over the data.

The analysis of variance which is generated for each regression type prints the following values:

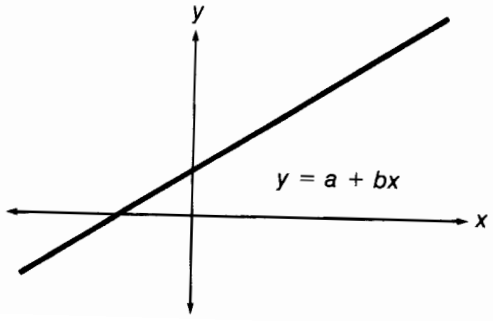
- Degrees of freedom
- Sum of squares
- Mean sum
- F-ratio
- r^2

The value of the F-ratio is set to 999.9 if it is greater than 999.9. Therefore if the r^2 value is close or equal to 1, the value of the F-ratio will be printed as 999.9.

Negative and zero values of x_i will cause a displayed error for logarithmic curve fits. Negative and zero values of y_i will cause a displayed error for exponential curve fits. For power curve fits both x_i and y_i must be positive, non-zero values.

As the differences between x and/or y values become small, the accuracy of the regression coefficients will decrease.

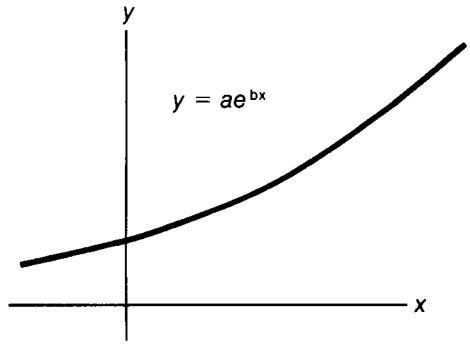
Linear



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

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

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

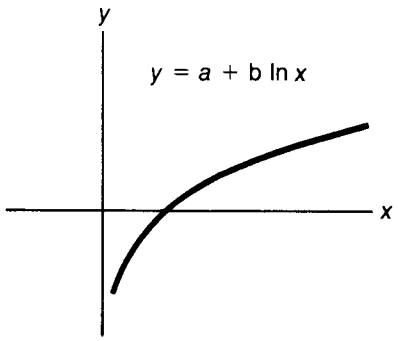


Exponential

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

$$a = \exp\left[\frac{1}{n}(\Sigma \ln y_i - b\Sigma x_i)\right]$$

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

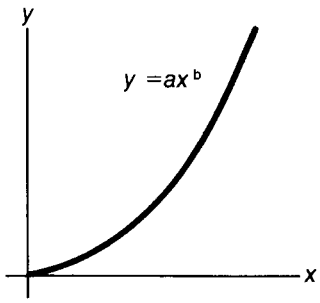


Logarithmic

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

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

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



Power

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

$$a = \exp\left[\frac{1}{n}(\Sigma \ln y_i - b\Sigma \ln x_i)\right]$$

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

The curve fitting program permits you to specify a chart title, a chart subtitle, and a legend for each curve. You can obtain a value for $\hat{y}$ for each curve, and you have the option of plotting the curve or of calculating the values without plotting. An additional option permits you to treat X-axis data as time intervals (that is, to normalize X-axis data beginning with a value of 1) so that negative, zero, or very large X values do not cause erroneous results.

As with the line chart program, the curve fitting program requires that you know the values of the data; a special option permits review of the raw data in the /PD VisiCalc data file.

File Format for Curve Fitting

In order to use VZCURV, the VisiCalc data file you create with the /PD command must contain the (x,y) data points arranged in two adjacent rows or columns.

User Instructions for Curve Fitting

To load the curve fitting program, insert the VisiCalc PLUS disc into the disc drive and type LOAD "VZCURV" (END LINE).

To run the program, press (RUN). LINCURg and REDZERg will be loaded automatically by VZCURV, and you will be asked to specify a printer device number. This will determine where your printed output will go throughout the VZCURV program.

Make sure a suitable VisiCalc data file (/PD file) is available for the curve, or that a converted VisiCalc data file is available on a disc in the disc drive. Whenever VZCURV prompts you for a file name, you can first press (END LINE) to generate a directory of the files on the disc. The directory is routed to the current PRINTER IS device.

Data File Selection—VZCURV prompts `Select type: (V/C)` to ask for the type of data file.

If your file is a converted VisiCalc data file—enter C (END LINE). VZCURV prompts `Enter file name: -OR- Press [END LINE] for catalog` so that it can find your file. You now have the option of pressing (END LINE) to get a listing of all files on the disc. The listing will come out on the current PRINTER IS device. After you have taken or declined this option you must enter the file name, followed by (END LINE). Continue with *Select Options.*

If your file is a /PD file—enter V (END LINE) and continue.

Data Set-Up—VZCURV displays `Enter name of file with data to fit -OR- Press [END LINE] for catalog ?`. You have the option of pressing (END LINE) first to generate a file directory for the disc.

Then you must enter the name of the file with the data ((x,y) coordinates), followed by (END LINE).

You can review the data on the /PD file to help answer the prompts you will receive about file format, X-axis and Y-axis scaling, values, and labels. When `Review data... Select: (P/D/N)` is displayed, you can press P to print the file, or you can press D to display it, or you can press (END LINE) to continue without reviewing the data. If you choose to review the data you must then press (CONT) to continue.

When you see `File format: 2 Rows or 2 Columns: (R/C) ?`, you should press R (END LINE) if your data points are arranged in 2 rows. If your data points are in 2 columns, press C (END LINE).

If your data is in two rows—VZCURV prompts `X-axis row: (Upper or Lower) ?` You should press L (END LINE) if the lower row in your file contains X-coordinates. If the upper row has the X-coordinates, press (END LINE).

If you data is in two columns—VZCURV prompts `X-axis column: (Left or Right)`. You should press R (END LINE) if the right-hand column in your file contains the X-coordinates. If the left-hand column has the X-coordinates, press (END LINE).

Points to Plot—The program returns the number of data points in the specified row or column. When `First point to graph: (Default is point 1) ?` is displayed, you can press (END LINE) to begin the graph with the first data point, or you can enter the number (1, 2, 3, etc.) of the first data point to be graphed, followed by (END LINE).

Next, VZCURV prompts you for the `Last point to graph: (Default is` (last point) `) ?`. You can press (END LINE) to end the graph with the last data point, or you can enter the number of the last data point to be graphed, followed by (END LINE).

Note: If an invalid data point is entered, the program will re-execute *Points to Plot.*

VZCURV now asks you to `Select pen color: ... Enter 1-8 ?`. Enter 1 (black), 2 (red), 3 (blue), 4 (green), 5 (lime), 6 (gold), 7 (orange), or 8 (brown) to select the color of ink you want for the data points. Then press (END LINE).

Axes Set Up—When `Grid (Y/N) ?` is displayed, press (END LINE) for a plain graph, or Y (END LINE) for one on a grid.

VZCURV will now prompt you for `Minimum X-axis value ?` and then for `Maximum X-axis value ?`. Enter the smallest and largest value to be plotted, and follow each response with (END LINE).

Now VZCURV wants to know the `Number of units between X-axis labels ?`, and then the `Number of units between X-axis tics ?`. For each of these successive prompts, enter the value (distance) you want between each label or tic on the X-axis, followed by (END LINE).

When `Minimum Y-axis value ?` is displayed, enter the smallest Y-coordinate value to be graphed, followed by (END LINE). Do the same for the largest Y-coordinate value to be graphed when `Maximum Y-axis value ?` is displayed.

Next, VZCURV will prompt successively for `Number of units between Y-axis labels ?` and `Number of units between Y-axis tics ?`. Handle these the same as you did the X-axis labels and tics.

Charts Titles—`Enter chart title ( 32 character maximum) ?` is now displayed. If you do not need a main title, press (END LINE).

If you need a main title, enter it (1-32 characters), followed by (END LINE). VZCURV prompts `Slanted label: (Y/N) ?` and accepts either a Y (END LINE) response for a slanted label, or an (END LINE) response for a plain one.

When you see `Enter chart subtitle ( 32 character maximum) ?` VZCURV is ready for you to enter the chart's subtitle. If no subtitle is desired, respond with (END LINE) without entering a label.

If you want a subtitle, enter it followed by (END LINE). VZCURV will give you the same slanted label option.

VZCURV will now prompt you with `Enter X-axis title ( 32 character maximum) ?`, and later with `Enter Y-axis title ( 32 character maximum) ?`. Both of these labels can be from 1 to 32 characters long, either or both can be slanted (you will receive the familiar "slant" prompt for each). Either or both can also be blanked (no label printed) by pressing (END LINE) without entering a label.

Curve Declaration—If X-axis data contains negative, zero, or very large values, regression analyses may be inaccurate or may not even be computed. To avoid this, treat the data as time intervals. VZCURV knows this, and gives you a chance to protect against it; it displays `Do you want X-axis data treated as time intervals: (Y/N) ?`. Respond with Y (END LINE) if your X-axis data contains negative, zero, or very large values (values greater than 500). Respond with (END LINE) if your data contains no such values.

> **Note:** Treating X-axis data as time intervals causes the data to be normalized beginning with a value of 1. Thus, if the years 1981 to 1990 were treated as time intervals, 1981 would be computed in the regression analyses as 1, 1982 as 2, etc. The values still *appear* as 1981, 1982, etc., on the plot. If you are in doubt as to whether your data should be treated as time intervals, do it anyway. Treating data as time intervals will *never* give you an incorrect regression, even if such treatment is unnecessary.

Select Regression—`Select regression` is displayed and the special function keys (k1-k14) are labeled:

VZCURV is now waiting for you to declare the types of curves to be plotted. Keys k1-k4 can be used to declare a regression method. K5, CONTINUE, is used to continue without declaring all 4 types of curve fits. K6, HELP, displays more complete descriptions of the keys used in this step, and returns to *Select Regression.*

Once you have decided on a curve you want plotted, press that key and continue. If you want to plot less than 4 curves and you have already declared the ones you want, press key #5, CONTINUE , and continue with *Select Options.*

If the curve can be plotted, the current PRINTER IS device generates values for degrees of freedom, sum of squares, mean sum, F-ratio, and r^2.

Estimate Y—VZCURV then prompts `Estimate Y: (Y/N) ?`. If you want an estimate—enter Y (END LINE). You will be prompted to `Enter value of X ?`. Type in the value of X for which you need the function value, and follow it with (END LINE). The function value will be displayed and you will have a chance to ask for another estimate. Re-execute *Estimate Y.*

If you do not want an estimate—press (END LINE) and continue.

Plotting Declarations—VZCURV now asks `Do you want this regression line plotted: (Y/N) ?`.

If you do not want the curve plotted—press (END LINE). Continue with *Select Regression.*

If you want the curve plotted—press Y (END LINE) and continue.

You are now asked to `Select pen color: ... Enter 1-8 ?`. Enter 1 (black), 2 (red), 3 (blue), 4 (green), 5 (lime), 6 (gold), 7 (orange), or 8 (brown) followed by (END LINE) to select the color of ink for this line. (Default color is black.)

VZCURV prompts `Legend for Line number` (line number) `(FIRST 12 characters) ?` to ask you for the first part of a line legend. If you don't want a line legend, just press (END LINE).

If you want a line legend, enter it (up to 12 characters) and press (END LINE); VZCURV will then prompt `Slanted label: (Y/N) ?` and allow you to declare a plain label (upright) with (END LINE) or a slanted one with Y (END LINE).

Now VZCURV displays `Legend for Line number` (line number) `(LAST 12 characters) ?`. If the second part of the line legend is not needed, just press (END LINE).

If you want the line legend to have a second part, enter it (again, 12 characters or less) and press (END LINE); VZCURV will again prompt `Slanted label: (Y/N) ?` and allow you the choice of a plain label (press (END LINE)) or a slanted one (press Y (END LINE)).

If all regression lines have been specified, proceed to *Select Option;* otherwise, continue with *Select Regression.*

Note: If all the regression values for all four possible curves have been computed, the program displays `ALL LINES COMPUTED`. Go to *Select Option.*

Select Option—Select option is displayed and the special function keys (k1-k14) are labeled:

VZCURV is now waiting for you to declare the next task to be accomplished. Here are short descriptions of the key functions: key #1, PLOTTER, plots the graph on a peripheral plotter; key #2, SAVE DATA, creates a converted VisiCalc data file from the current data, so that it can be easily replotted; key #3, GET DATA, helps you load a VisiCalc data file or a converted VisiCalc data file and re-execute VZCURV to plot the new data; key #4, LIST, lists all data, titles, labels, etc. of the set of lines; key #5, EDIT, lets you re-enter the data values to be plotted, graph titles, axes specifications, or the regression lines to be plotted; key #6, HELP, displays more complete descriptions of these key functions; key #7, EXIT, ends the VZCURV program and returns the computer to calculator mode; and key #8, CRT PLOT, returns an abbreviated plot on the CRT screen.

Once you have decided on your next course of action, press that key and continue with the paragraph labeled with that key's name.

Key #1, PLOTTER —Select type of plotter: ... Enter (1-3) ? requires a response of 1 (END LINE) if the HP 7225 Plotter is being used, a response of 2 (END LINE) if the HP 7470 Plotter is in use, or a response of 3 (END LINE) if you will be using the HP 9872 Plotter. If your plotter is the HP 9872, VZCURV will now prompt you for the number of pens your version uses.

When Enter plotter address or press [END LINE] for AUTO-SCAN ? is displayed, enter the plotter device address and press (END LINE). (Refer to the plotter user's manual for its address. A typical peripheral plotter address is 705.)

If you don't know or aren't sure of the address, press (END LINE) instead and the computer will try to find the plotter. If the plotter cannot be found, continue these directions with *Select Option.*

When Prepare the plotter and press [CONT] is displayed, ensure that paper is in the plotter; then press (CONT) to allow the curves to be plotted.

Follow the plotting directions on the CRT while the plot is being made.

Once plotting is complete, return to *Select Option.*

Key #2, SAVE DATA —VZCURV asks you to Enter file name: -OR- Press [END LINE] for catalog. If you want a catalog of files on the disc, press (END LINE) first. (This is a good method for avoiding accidental file name duplications.) Then enter the file name for the new converted VisiCalc data file you are creating, followed by (END LINE).

If you *do not* see the prompt `File name` (file name) `already exists. Select option: (O/R/C)` you can now go back to *Select Option* to assign the next task. But if you do see it, you have duplicated a file name, and must continue.

You must do one of three things: enter O (END LINE) to overwrite the old file with the new data and continue with *Select Option,* or enter R (END LINE) to rename the new file and repeat the directions for key #2, SAVE DATA , or enter C (END LINE) to cancel the store operation and continue with *Select Option.*

Key #3, GET DATA —This key will allow you to re-execute VZCURV with a new data file. Continue with the directions for *Data File Selection.*

Key #4, LIST —The listing is routed to the current PRINTER IS device, so if it comes out on the wrong device you may want to (PAUSE) the VZCURV program, redefine PRINTER IS, restart VZCURV with (CONT) and re-execute this key function. Once the listing is complete you can return to *Select Option* and choose another task.

Edit Select Options—Key #5, EDIT —You can now re-enter graph information before plotting. `Select option` is displayed and the special function keys are relabeled:

Key #1, CONTINUE , continues with *Select Option* after all editing has been accomplished.

Key #3, PLOT PTS. , lets you re-enter the points you want to graph, and the axes, labels and curves to be computed and plotted on the graph. Go back to *Points to Plot* and use those directions.

Key #4, AXES ,lets you re-enter the axes and labels, and the curves to be computed and plotted on the graph. Go back to *Axes Set-Up* and start using those directions.

Key #5, CURVES , allows you to re-enter the curves to be computed and plotted on the graph. Go back to *Curve Declaration* and use those directions.

Key #7, HELP , displays more complete descriptions of the keys used in this step; continue with the *Edit Select Options.*

Key #6, HELP —This key displays descriptions of the functions of the special function keys and returns you to *Select Option.*

Key #7, EXIT —This key will end the VZCURV program and return the computer to calculator mode. A special safety feature requires that you press Y (END LINE) to confirm that you want to end VZCURV, and prevents accidental exits.

Key #8, CRT PLOT —The curves will be plotted on the CRT screen in an abbreviated form. When plotting is complete, press (CONT) to again see the functions of the special function keys. Then continue with *Select Option* and decide on your next course of action.

Example. Using the data here, which you can load from the XYZ file on the VisiCalc PLUS disc, determine which curve best fits the projected data for net sales for the XYZ Corporation. The X-axis data should be treated as time intervals.

Years ending June 30	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
NET SALES	236	288	374	468	510	561	684	849	1078	1164

ANALYSIS OF VARIANCE
LINEAR REGRESSION

SOURCE	DEG OF FREEDOM	SUM OF SQUARES	MEAN SUM	F RATIO
TOTAL	9	919103.60		
REGRESSION	1	871230.11	871230.11	145.59
RESIDUAL	8	47873.49	5984.19	

R SQUARE = 0.948

REGRESSION COMPUTED WITH 1981 = 1

YHAT=5.6000E+001 +1.0276E+002 X

ANALYSIS OF VARIANCE
LOGARITHMIC REGRESSION

SOURCE	DEG OF FREEDOM	SUM OF SQUARES	MEAN SUM	F RATIO
TOTAL	9	919103.60		
REGRESSION	1	705957.47	705957.47	26.50
RESIDUAL	8	213146.13	26643.27	

R SQUARE = 0.768

REGRESSION COMPUTED WITH 1981 = 1

YHAT=4.410E+001+3.821E+002LOG(X)

ANALYSIS OF VARIANCE
EXPONENTIAL REGRESSION

SOURCE	DEG OF FREEDOM	SUM OF SQUARES	MEAN SUM	F RATIO
TOTAL	9	2.57		
REGRESSION	1	2.54	2.54	693.62
RESIDUAL	8	0.03	0.00	

R SQUARE = 0.989

REGRESSION COMPUTED WITH 1981 = 1

YHAT=2.092E+002EXP(1.754E-001 X)

ANALYSIS OF VARIANCE
POWER REGRESSION

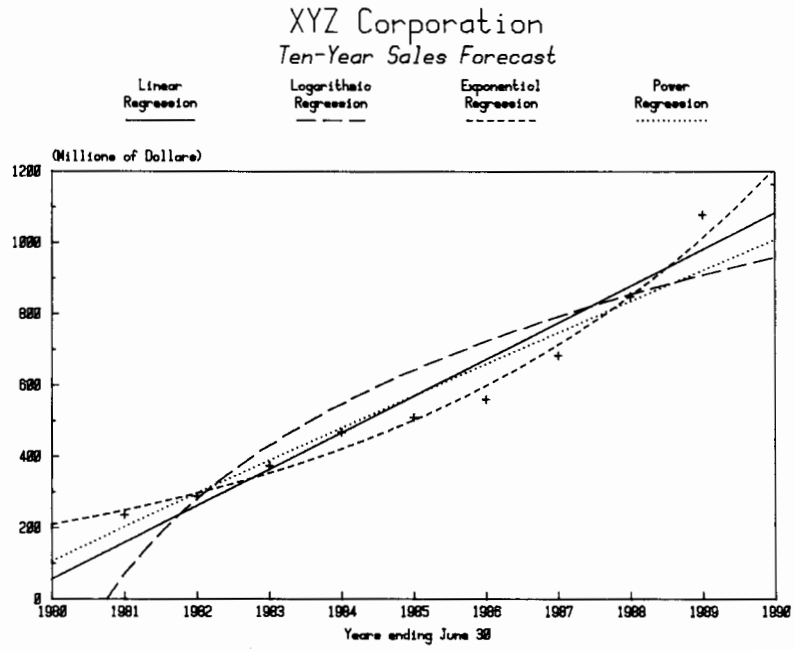
SOURCE	DEG OF FREEDOM	SUM OF SQUARES	MEAN SUM	F RATIO
TOTAL	9	2.57		
REGRESSION	1	2.36	2.36	93.93
RESIDUAL	8	0.20	0.03	

R SQUARE = 0.922

REGRESSION COMPUTED WITH 1981 = 1

YHAT=1.9087E+002X ^ 6.9929E-001

As you can see from the r^2 values, the curve which best fits the projected sales data is the exponential curve.



Pie Charts

The VZPIE program permits the data in a VisiCalc data file or a converted VisiCalc data file to be used to create pie charts. A converted VisiCalc data file is a file that has been stored from the VZPIE program and which contains all graphing information in addition to data. From a single file, you can plot one pie; if two files exist, two pies may be plotted on the same sheet. Each pie may contain between two and 25 slices, inclusive.

Each VZPIE slice may be specified in any of eight pen colors. In addition, you can specify one of six different shadings (hatchings) for a slice, and you can plot the slice as normal or exploded. Another option allows you to label each slice with the percentage of the entire pie it contains.

File Format for Pie Charts

In order to use VZPIE, each VisiCalc data file you create with the /PD command must be made up of either two adjacent rows or two adjacent columns, with the following sets of data:

- Cells of the first row or column contain labels for slices. A maximum of 15 characters per label is allowed. Use the VisiCalc /GC command to set global column width to 15 characters or less before storing the data with /PD.
- Cells of the second row or column contain data for slices.

User Instructions for Pie Charts

To load the pie chart program, insert the VisiCalc PLUS disc into the disc drive and type LOAD "VZPIE" (END LINE).

To run the program, press (RUN). LINCURg will be loaded automatically by VZPIE, and you will be asked to specify a printer device number. This will determine where your printed output will go throughout the VZPIE program.

Make sure a suitable VisiCalc data file (/PD file) is available for each pie (up to two), or that a converted VisiCalc data file is available on a disc.

Whenever VZPIE prompts you for a file name, you can first press (END LINE) to generate a directory of the files on the disc. The directory is routed to the current PRINTER IS device.

Data File Declaration—VZPIE prompts `Select type: (V/C) ?` to ask for the type of data file.

If your file is a converted VisiCalc data file—enter C (END LINE). VZPIE prompts `Enter file name: -OR- Press [END LINE] for catalog` so that it can find your file. You now have the option of pressing (END LINE) to get a listing of all files on the disc. After you have taken or declined this option you must enter the file name, followed by (END LINE). Continue with *Select Option.*

If your file is a /PD file—enter V (END LINE). VZPIE prompts Enter number of pies: (1 or 2) ?. If you will plot two pies, a separate VisiCalc data file must exist for each pie. Enter the number of pies (files), press (END LINE) and continue.

Data File Selection—When Enter data file name for pie number (pie number) : Press [END LINE] for catalog is displayed, you again have the (END LINE) option to see the file directory. After this option enter the name of the file with the slice labels and data for the indicated pie, then press (END LINE).

> **Note:** If the VisiCalc data file (/PD file) will produce fewer than two slices, or if the file you have selected is not a /PD file, the program displays PROGRAM ENDED. Press the (RUN) key to restart the program.

When you see File format: 2 Rows or 2 Columns: (R/C) ?, you should press R (END LINE) if your file consists of two rows. If your file has two columns, press C (END LINE).

If this was only the first of two data files, go back to *Data File Selection* and follow the directions again for the second file.

Slice Declaration—For each slice, the program displays the value and the label. When Slanted label: (Y/N) ? is displayed, VZPIE allows you to declare a slanted label with Y (END LINE) or a plain label (upright) with (END LINE).

The display now reads Select pen color: ... Enter 1-8 ?. Enter 1 (black), 2 (red), 3 (blue), 4 (green), 5 (lime), 6 (gold), 7 (orange), or 8 (brown) followed by (END LINE) to select the color of ink for this pie slice. (Default color is black, or the highlighted code if editing.)

When Select hatch code: ... Enter 1-6? is displayed, enter 1, 2, 3, 4, 5, or 6, followed by (END LINE), to select the type of hatching for the pie slice. Default is no hatching, or the highlighted code if editing.

When you see Exploded slice: (Y/N) ? , you may cause the slice to be exploded (set off) from its pie. If you want the slice to be exploded, press Y (END LINE). If you don't want the slice exploded, press (END LINE).

If there are still more slices to be declared for this pie, execute *Slice Declaration* for each remaining slice.

Chart Titles—Pie # (pie number) Subtitle label (32 character maximum) ? is now displayed. If you do not need a subtitle for this pie, press (END LINE).

If you need a subtitle, enter it (1-32 characters) followed by (END LINE). VZPIE prompts Slanted label: (Y/N) ? and accepts either a Y (END LINE) response for a slanted label, or an (END LINE) response for a plain one.

If this is the first of two pies, continue with *Slice Declaration* for the second pie.

When you see `Chart title label (32 character maximum) ?` VZPIE is ready for you to enter the chart's title. If you do not want a title, press END LINE.

If you want a title, enter it (1-32 characters) followed by END LINE. VZPIE will give you the slanted label option, which you should answer in the usual way.

Select Option—The special function keys (k1-k14) are labeled:

VZPIE is now waiting for you to declare the next task to be accomplished. Here are short descriptions of the key functions: key #1, FINAL PLOT, produces a final (complete) plot; key #2, SAVE DATA, saves data, labels, slice labels, and hatch and slant codes as a converted VisiCalc data file on the disc; key #3, CRT PLOT, produces an abbreviated plot on the CRT screen; key #4, LIST, lists titles, labels, slice labels, and hatch and slant codes on the current PRINTER IS device; key #5, EDIT, lets you re-enter the current pie specifications; key #6, HELP, displays more complete descriptions of these key functions; key #7, EXIT, ends the VZPIE program and returns the computer to calculator mode; key #8, FAST PLOT, produces a fast plot (no hatching and in one color); and key #9, GET DATA, helps you load a VisiCalc data file (or a converted VisiCalc data file) and re-execute VZPIE to plot the new data.

Once you have decided on your next course of action, press that key and continue with the paragraph labeled with that key's name.

Key #1, FINAL PLOT —When `Enter plotter address or press [END LINE] for AUTO-SCAN ?` is displayed, enter the plotter address and press END LINE. (Refer to the plotter user's manual for its address. A typical peripheral plotter address is 705.)

If you don't know or aren't sure of the address, press END LINE instead, and the computer will try to find the plotter. If the plotter cannot be found, continue these directions with *Select Option.*

`Select type of plotter: ... Enter (1-3) ?` requires a response of 1 END LINE if the HP 7225 Plotter is being used, or a response of 2 END LINE if the HP 7470 Plotter is in use, or a response of 3 END LINE if the HP 9872 Plotter will be used. If your plotter is an HP 9872, VZPIE will now prompt you for the number of pens your version uses.

VZPIE then asks `Do you wish to have the percentages labeled (Y/N) ?`. If you do not want the slices labeled with percentages, press END LINE. If you want the percentages labeled, press Y END LINE.

Note: Percentage values are truncated (not rounded) to one decimal place.

When `Prepare the plotter and press [CONT]` is displayed, ensure that paper is in the plotter. Then press (CONT) and follow the displayed instructions (which will vary, depending on the plotter used). When the plot is complete, return to *Select Option.*

Key #2, SAVE DATA —VZPIE asks you to `Enter file name: -OR- Press [END LINE] for catalog`. If you want a catalog of files on the disc, press (END LINE) first. (It is a good idea to see the catalog, to keep from accidentally duplicating a file name.) Then enter the file name for the new converted VisiCalc data file you are creating, followed by (END LINE).

If you *do not* see the prompt `File name` (file name) `already exists. Select option: (O/R/C)`, you can now go back to *Select Option* to assign the next task. But if you do see it, you have duplicated a file name, and must continue.

You must do one of three things: enter O (END LINE) to overwrite the old file with the new data and continue with *Select Option,* or enter R (END LINE) to rename the new file and repeat the directions for key #2, SAVE DATA , or enter C (END LINE) to cancel the store operation and continue with *Select Option.*

Key #3, CRT PLOT —This plots an abbreviated chart on the CRT screen. When plotting is complete, press (CONT), and continue with *Select Option.*

Note: If two pies are being plotted on the CRT screen, pie subtitles greater than 28 characters in length are represented by a box, rather than being printed out.

Key #4, LIST —The listing is routed to the current PRINTER IS device, so if it comes out on the wrong device you may want to (PAUSE) the VZPIE program, redefine PRINTER IS, restart VZPIE with (CONT), and re-execute this key function. Once the listing is complete you can return to *Select Option* and choose another task.

Key #5, EDIT VZPIE will ask `Edit slice specifications (Y/N) ?`. If you want to edit only the pie and chart titles, press (END LINE) and continue with *Chart Titles.* However, if you also want to edit the slice specifications, press Y (END LINE) and continue with *Slice Declaration.*

Key #6, HELP —This key displays descriptions of the functions of the special function keys and returns you to *Select Option.*

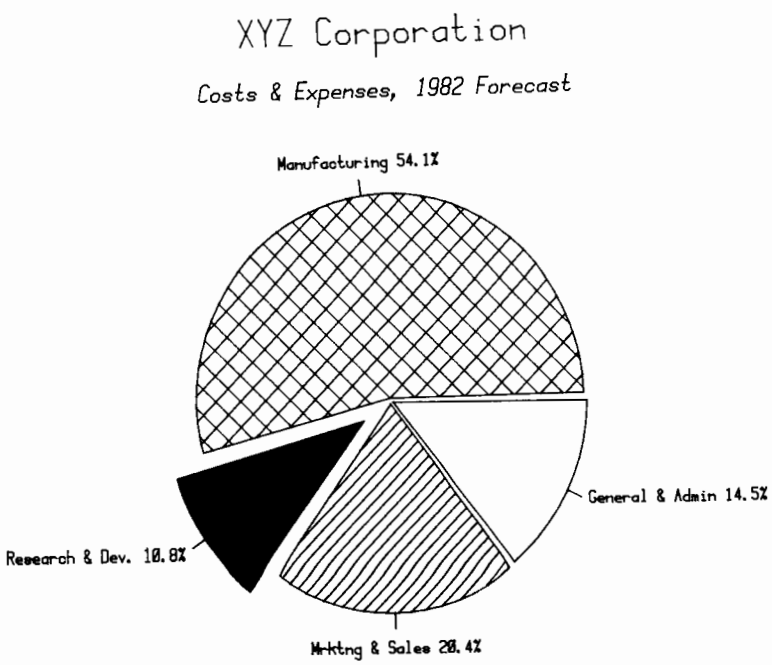
Key #7, EXIT —This key will end the VZPIE program and return the computer to calculator mode. A special safety feature requires that you press Y (END LINE) to confirm that you want to end VZPIE, and prevents accidental exits.

Key #8, FAST PLOT —This key accomplishes the same plot as Key #1, FINAL PLOT , except that the slices will have no hatching and are drawn in one color. Follow the instructions for FINAL PLOT.

Key #9, GET DATA —continue with *Data File Declaration.*

Example. Use the data below for the XYZ Corporation to show the proportions of total costs and expenses for the year 1982.

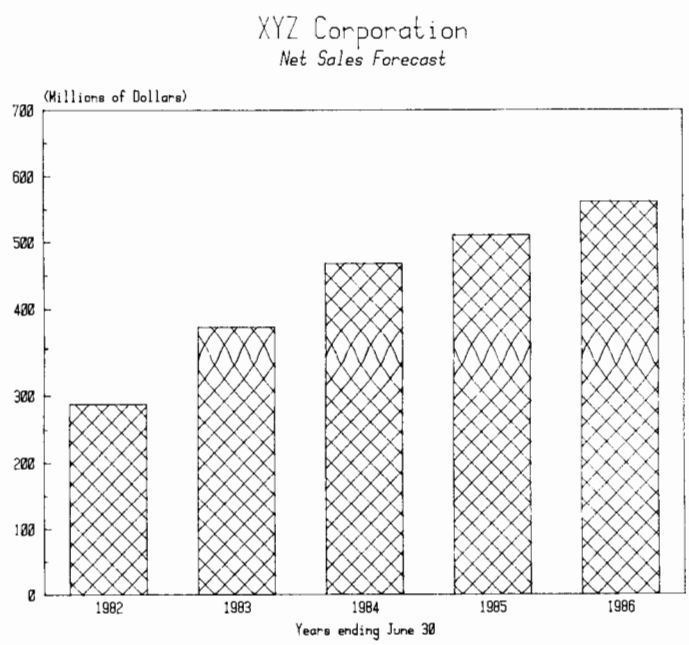
Years ending June 30	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
NET SALES	236	288	374	468	510	561	684	849	1078	1164
COSTS AND EXPENSES: .										
COST OF GOODS SOLD	123	130	176	225	260	275	308	416	528	605
RESEARCH & DEVELOP	19	26	34	35	41	50	62	72	86	93
MARKETING & SALES	42	49	64	80	97	95	110	136	172	198
GENERAL & ADMIN .	33	35	49	56	71	67	89	102	129	163
TOTAL	217	239	322	395	469	488	568	726	916	1059



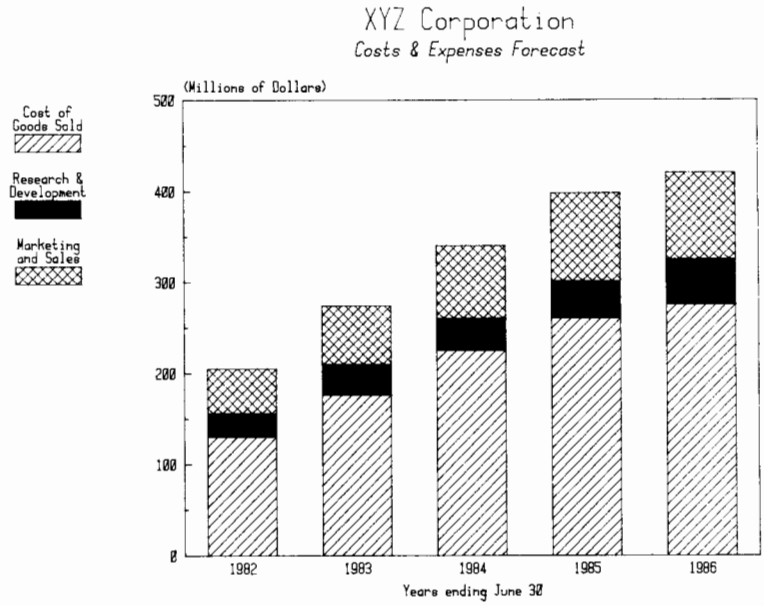
Bar Charts

The VZBAR program permits the data in a VisiCalc data file or a converted VisiCalc data file to be used to create a bar chart. A converted VisiCalc data file is a file that has been stored from the VZBAR program and which contains all graphing information in addition to data. From a single VisiCalc data file you can plot from one to 25 bars. Bars may also be stacked or clustered; each cluster or stack may contain a bar from each of up to six VisiCalc data files.

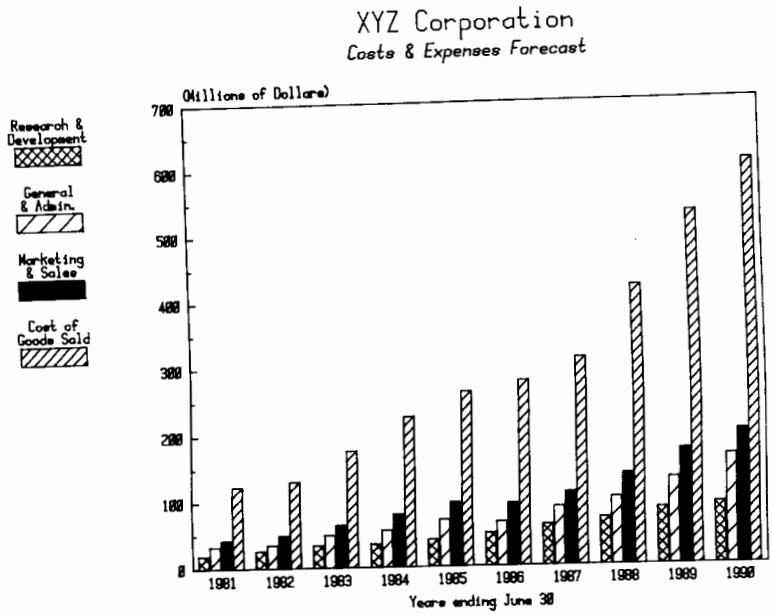
When plotting bars, you have the option of eight pen colors, and any of six shading (hatching) options. These plotting options, along with the upright or slanted legends, make it easy to identify the bars in a cluster or stack.



Normal Bars



Stacked Bars



Clustered Bars

File Format for Bar Charts

In order to use VZBAR, each VisiCalc data file you create with the /PD command must be made up of a single row or column of numbers.

In order to create a graph of 10 clusters, with three bars in each cluster, you would need three /PD files, and each file would be a single row or column of 10 data values.

User Instructions for Bar Charts

To load the bar chart program, insert the VisiCalc PLUS disc into the disc drive and type LOAD "VZBAR" (END LINE).

To run the program, press (RUN). VZBAR will automatically load LINCURg and REDZERg, and you will be asked to specify a printer device number. This will determine where your printed output will go throughout the VZBAR program.

Make sure a suitable VisiCalc data file (/PD file) is available for each line, or that a converted VisiCalc data file is available on the disc.

Whenever VZBAR prompts you for a file name, you can first press (END LINE) to generate a directory of the files on the disc currently in the disc drive. The directory is routed to the current PRINTER IS device.

Data File Declaration—VZBAR prompts `Select type: (V/C) ?` to ask for the type of data file.

If your file is a converted VisiCalc data file—enter C (END LINE). VZBAR prompts `Enter file name: -OR- Press [END LINE] for catalog` so that it can find your file. You now have the option of pressing (END LINE) to get a listing of all files on the disc. After you have taken or declined this option you must enter the file name, followed by (END LINE). Continue with *Select Option.*

If your file is a /PD file—enter V (END LINE). VZBAR asks you to `Select type of bar chart... Select option: (N/S/C) ?` to declare a normal, stacked, or clustered bar chart. If you want a normal bar chart, press N (END LINE) and continue with *Data File Selection.* If you want a stacked or clustered bar chart, press S or C (S for stacked, C for clustered), and follow your selection with (END LINE). When you see `Enter the number of bars in each stack/cluster 1-6?`, enter the number of files to be plotted (each file, up to six, is plotted once in each stack or cluster) and follow this with (END LINE).

Data File Selection—When `Enter file name for legend number` (legend number) `: -OR- Press [END LINE] for catalog` is displayed, you again have the (END LINE) option to see the file directory. After this option, enter the name of the file with the data for this set of bars and press (END LINE).

If you have selected a normal bar chart, continue with *Pen Color.*

Legends—VZBAR prompts `Label for legend (FIRST 12 characters) ?` to ask you for the first part of a bar legend. If you do not want a legend for this set of bars, press (END LINE).

If you want a legend, enter it (up to 12 characters) and press (END LINE).

VZBAR prompts `Label for legend (LAST 12 characters) ?` to ask you for the last part of a bar legend. If you do not want a legend, or if you want only the first part of a legend, press (END LINE).

If you want the second part of a legend, enter it and press (END LINE).

If you have not entered either a first or last part of a legend, continue with *Pen Color.*

VZBAR will prompt `Slanted label: (Y/N) ?` if any part of a legend has been entered. Respond with (END LINE) if you want a plain (upright) label. Respond with Y (END LINE) if you want a slanted one.

Pen color—The display now reads `Select pen color: ... Enter 1-8 ?`. Enter 1 (black), 2 (red), 3 (blue), 4 (green), 5 (lime), 6 (gold), 7 (orange), or 8 (brown) for this file of bars. (Default color is black, or the highlighted code if editing.) Then press (END LINE).

When `Select hatch code: Enter 1-6 ?` is displayed, enter 1, 2, 3, 4, 5, or 6 followed by (END LINE) to select the type of hatching for this file of bars. (Default is hatch code of current legend, which is highlighted.)

If data is being entered for the first time and more data files remain to be selected, go back to *Data File Selection.* If data is being entered for the first time and all new files have been selected, continue with *Titles and Labels.*

If data is being edited and more files remain to be edited, go back to *Legends.* If data is being edited and all files of bars have been corrected, continue with *Edit Titles.*

Titles and Labels—The next two prompts you will see are `Enter chart title ( 32 character maximum) ?` and `Enter chart subtitle ( 32 character maximum) ?`. If you do not want either or both of these titles, press (END LINE) following that prompt. If you want either or both of these titles, enter the title (1-32 characters) when you are prompted and press (END LINE). VZBAR will then give you the slanted label option which you should answer as usual.

Next, VZBAR will ask you to `Enter Y-axis title ( 32 character maximum) ?` and then to `Enter X-axis title ( 32 character maximum) ?`. Again, if you do not want either or both of these axes titles, press (END LINE) for the appropriate prompt.

If you want either or both of these axes titles, enter the title (1-32 characters) when you are prompted and press (END LINE). VZBAR will once again give you the familiar slanted label option for each entered title.

X-axis Labels—The next prompt should be `Enter X-axis labels: Label #` (label number). If no label is desired, clear the label on the cursor line with (-LINE) and press (END LINE).

If you want a label for the specified normal bar, or for a stack or cluster of bars, enter it (1-20 characters) and press (END LINE).

VZBAR again gives you the slanted label option for this label.

After a label has been entered, it will be left on the screen to be used in the next label position or if you are editing a label, the old label will be displayed on the screen. You may use this label as is, alter it to fit the position, or replace it by a new label.

If all labels have been specified, continue with *Select Option.* Otherwise, go back to *X-axis Labels* until you are finished entering labels.

Select Option—`Select option` is displayed and the special function keys (k1-k14) are labeled:

VZBAR is now waiting for you to declare the next task to be accomplished. Here are short descriptions of the key functions: key #1, FINAL PLOT, generates a final plot, with all hatching, on a peripheral plotter; key #2, SAVE DATA, creates a converted VisiCalc data file from the current data, so that it can be easily replotted; key #3, CRT PLOT, creates an abbreviated plot on the CRT screen; key #4, LIST, lists all data, titles, labels, etc. of this set of bars; key #5, EDIT, lets you edit the current bar specifications; key

#6, HELP, displays more complete descriptions of these key functions; key #7, EXIT, ends the VZBAR program and returns the computer to calculator mode; key #8, FAST PLOT, creates the same plot as FINAL PLOT, but without any hatching; and key #9, GET DATA, helps you load a VisiCalc data file (or a converted VisiCalc data file) and re-execute VZBAR to plot the new data.

Once you have decided on your next course of action, press that key and continue with the paragraph labeled with that key's name.

Key #1, FINAL PLOT —When `Enter plotter address or press [END LINE] for AUTO-SCAN ?` is displayed, enter the plotter address and press (END LINE). (Refer to the plotter user's manual for its address. A typical peripheral plotter address is 705.)

If you don't know or aren't sure of the address, press (END LINE) instead, and the computer will try to find the plotter. If the plotter cannot be found, press (CONT) and continue with *Select Option.*

VZBAR will now ask for `Minimum Y-axis value ?` and then for `Maximum Y-axis value ?`. For these prompts, enter the smallest and largest values to be graphed, respectively. Follow each response with (END LINE).

VZBAR now wants to know `Number of units between Y-axis labels ?`. Enter the increment (distance) you want between each label on the Y-axis, followed by (END LINE).

If this is a plot on the CRT screen continue with *Select Option.*

`Select type of plotter: ... Enter (1-3) ?` requires a response of 1 (END LINE) if the HP 7225 Plotter is being used, or a response of 2 (END LINE) if yours is the HP 7470 Plotter, or a response of 3 (END LINE) if you have the HP 9872. If your plotter is an HP 9872, VZBAR will now prompt you for the number of pens your version uses.

When `Prepare the plotter and press [CONT]` is displayed, ensure that paper is in the plotter; then press (CONT). When the plot is complete, return to *Select Option.*

Key #2, SAVE DATA —VZBAR asks you to `Enter file name: -OR- Press [END LINE] for catalog`. If you want a catalog of files on the disc, press (END LINE) first. (This is a good method to prevent accidental duplication of a file name.) Then enter the file name for the new converted VisiCalc data file you are creating, followed by (END LINE).

If you *do not* see the prompt `File name` (file name) `already exists. Select option: (O/R/C)`, you can now go back to *Select Option* to assign the next task. But if you do see it, you have duplicated a file name, and must continue.

You must do one of three things: enter O (END LINE) to overwrite the old file with the new data and continue with *Select Option,* or enter R (END LINE) to rename the new file and repeat the directions for key #2, SAVE DATA, or enter C (END LINE) to cancel the store operation and continue with *Select Option.*

Key #3, CRT PLOT —When the chart has been plotted on the CRT screen, press (CONT), and continue with *Select Option.*

Key #4, LIST —The listing is routed to the current PRINTER IS device, so if it comes out on the wrong device you may want to (PAUSE) the VZBAR program, redefine PRINTER IS, restart VZBAR with (CONT), and re-execute this key function. Once the listing is complete you can return to *Select Option* and choose another task.

Key #5, EDIT —VZBAR asks if you want to `Edit legend specifications (Y/N)?` . If you want this option, press Y (END LINE) and continue with *Legends.*

If you are satisfied with the current legends, press (END LINE) and continue.

Edit Titles—VZBAR now asks `Edit titles & axes labels: (Y/N) ?` . If you are satisfied with the current titles and axes labels, press (END LINE) and return to *Select Option.*

But if you want to edit them, press Y (END LINE) and continue with *Titles and Labels.*

Key #6, HELP —This keys displays descriptions of the functions of the special function keys and returns you to *Select Option.*

Key #7, EXIT —This key will end the VZBAR program and return the computer to calculator mode. A special safety feature requires that you press Y (END LINE) to confirm that you want to end VZBAR, and prevents accidental exits.

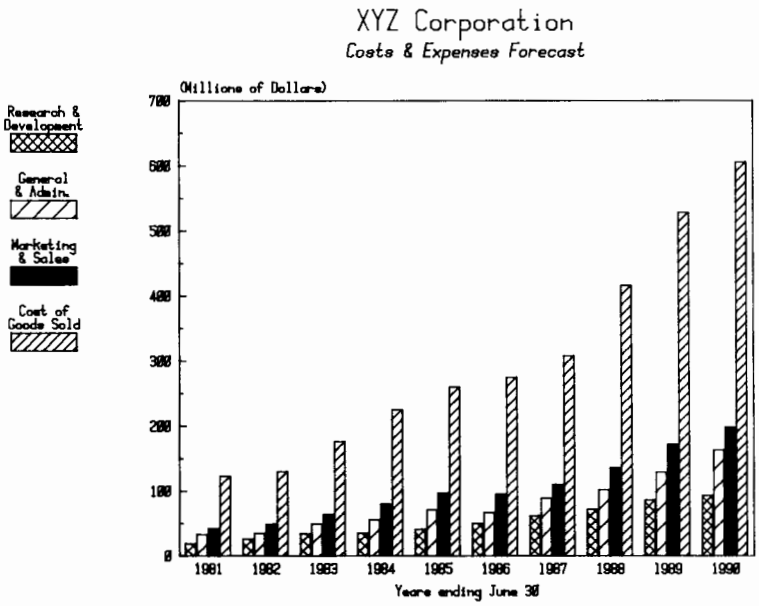
Key #8, FAST PLOT —This key will produce a non-hatched peripheral plot. Continue with the directions for key #1, FINAL PLOT .

Key #9, GET DATA —Go to *Data File Declaration.*

Example. Use the projected XYZ Corporation data below to generate a clustered bar graph that shows costs of goods sold, research and development, marketing and sales, and general and admin. from 1981 through 1990.

Years ending June 30

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
NET SALES	236	288	374	468	510	561	684	849	1078	1164
COSTS AND EXPENSES: .										
COST OF GOODS SOLD	123	130	176	225	260	275	308	416	528	605
RESEARCH & DEVELOP	19	26	34	35	41	50	62	72	86	93
MARKETING & SALES	42	49	64	80	97	95	110	136	172	198
GENERAL & ADMIN .	33	35	49	56	71	67	89	102	129	163



Appendix A

VisiCalc Functions and the Series 80 Personal Computer

This is a list of the functions available for use on Series 80 VisiCalc PLUS. In the following table, functions that are unique to VisiCalc are marked "VC", and may be found described in detail elsewhere in this manual. Series 80 functions that you can use in creating your VisiCalc worksheet are described in detail in the owner's manual for the computer.

Entry of functions must begin with either a + or @ symbol. However, the symbol is dropped when the entry is evaluated.

Functions which require one or two values as arguments will accept values, expressions or value references.

Function		Explanation
ABS(*x*)		Returns the absolute value.
ACS(*x*)		Arcosine in radians, in 1st or 2nd quadrant.
ASN(*x*)		Arcsine in radians, in 1st or 4th quadrant.
ATN(*x*)		Arctangent in radians, in 1st or 4th quadrant.
ATN2(*x*, *y*)		Arctangent in radians, of x/y, in proper quadrant.
AVERAGE(*range*)	VC	Computes the average of the values in a range. Example: AVERAGE(D2,D11).
CEIL(*x*)		Returns the smallest integer $\geq x$.
COS(*x*)		Cosine in radians.
COT(*x*)		Cotangent in radians.
COUNT(*range*)	VC	Returns the number of arithmetic entries in the range. Does not count null cells or cells with labels. Example: COUNT(A1,A12).
CSC(*x*)		Cosecant in radians.
DATE		Returns the Julian date in format YYDDD (assumes system timer properly set before starting VisiCalc).
DISCOUNT(*dr*, *range*)	VC	Computes the present value of the cash flows in the range, discounted at the decimal rate, dr. Similar to NPV except that the first range entry is the cash flow at the end of the first period, the second entry is the cash flow at the end of the second period, etc. Compare DISCOUNT and NPV: + A2 + DISCOUNT(.15,B2,F2) = + NPV(.15,A2,F2).

DTR(*x*)		Degree to radian conversion.
EPS		Smallest positive machine number (1E − 499).
ERROR	VC	Results in an "Error" value that makes all expressions using the value display ERROR.
EXP(*x*)		e^x (e = 2.71828182846).
FLOOR(*x*)		Largest integer $\leq x$. Same as INT(x).
FP(*x*)		Fractional part of x.
INF		Largest machine number (9.99999999999E499).
INT(*x*)		Largest integer $\leq x$. (e.g., INT(−7.2) = −8).
IP(*x*)		Integer part of x. (e.g., IP(−7.2) = −7).
IRR(*range*)	VC	Returns the internal rate of return using a range of cash flows as the argument. Example: IRR(B16,M16). Note: The IRR computation is iterative, not direct, and may take several seconds to complete. This will also increase worksheet recalculation time.
LGT(*x*)		Log to the base 10 of x, for $x > 0$.
LOG(*x*)		Natural logarithm, $x > 0$.
LOOKUP(*x*, *range*)	VC	Compares the value x to the values of successive entries in a range row or column, and selects as the result of the function the corresponding value from the column immediately to the right, or the row immediately below the entries in the range row/column. The values in the range are in ascending order, and the result is the value corresponding to the last entry in the range row/column that is less than or equal to x, before an entry greater than x is found. If the first entry in the range row/column is greater than x, then the result of the function is NA (Not Available, see function NA).
MAX(*x*, *y*)		If $x > y$, then x, else y.
MAXR(*range*)	VC	Computes the maximum value in the range. Cells containing labels or null cells have a zero value.
MEAN(*range*)	VC	Computes the mean of values in a range (same as AVERAGE).
MIN(*x*, *y*)		If $x < y$, then x, else y.
MINR(*range*)	VC	Computes the minimum value in a range. Cells containing labels or null cells have a zero value.
NA	VC	Results in a "Not Available" value that makes all expressions using the value display NA. Allows the effect of a particular value to be traced through the worksheet.
NPV(*dr*, *range*)	VC	Computes the net present value of the cash flows in the range, discounted at the decimal rate, dr. The first entry in the range is the cash flow at period zero (initial cash flow or initial investment). The second entry in the range is the cash flow at the end of the first period, etc. Example: NPV(A3,A2,F2) or NPV(.15,A2,F2), where A3

		contains the discount rate as a decimal value. A2,F2 is the range of cells to be evaluated and A2 is the initial investment.
PI		3.14159265359.
RMD(*x*, *y*)		Remainder of x/y: $x - y * \mathrm{IP}(x/y)$.
RND		Next number, x, in a sequence of pseudo-random numbers, $0 \leq x \leq 1$.
RTD(*x*)		Radian to degree conversion.
SEC(*x*)		Secant of x in radians.
SGN(*x*)		The sign of x; -1 if $x < 0$, 0 if $x = 0$, $+1$ if $x > 0$.
SIN(*x*)		Sine of x in radians.
SQR(*x*)		Positive square root of x.
STDEV(*range*)	VC	Computes the sample standard deviation of the values in a range.
SUM(*range*)	VC	Computes the sum of the values in a range. Example: SUM(B4,B11)
TAN(*x*)		Tangent of x in radians.
TIME		Time in seconds since midnight (assumes system timer properly set before starting VisiCalc).
VARIANCE(*range*)	VC	Computes the sample variance of the range values.

Appendix B

VisiCalc on HP Series 80 Computers

If you have extensive experience with VisiCalc on the HP-83/85 Personal Computer you will not find it necessary to read this entire manual. This appendix will inform you of the similarities and differences between this version of VisiCalc and the version which runs on the HP-83/85. It will also refer you to the sections in this manual which give details of the modified commands and features of this version of VisiCalc. However, if you have had no prior VisiCalc experience, then this manual is written for you. You should read it carefully and follow the examples.

VisiCalc Modifications

HP-86/87 VisiCalc is very similar to HP-83/85 VisiCalc. Any /PD or /SS files created from HP-83/85 VisiCalc can be used in HP-86/87 VisiCalc. Converted VisiCalc data files created from PLUS programs on the HP-83/85 can be used on the HP-86/87. This compatibility is reciprocal, except that HP-83/85 VisiCalc PLUS will not accept converted files which were created with more than four pen colors.

HP-86/87 VisiCalc requires no plug-in memory modules. Memory may be increased in increments of 32K, 64K, or 128K, if desired. The PLUS programs require at least 32K of plug-in memory.

HP-86/87 VisiCalc allows you to use any of three plotters (HP 7225, 7470, 9872). Up to eight pen colors are available for use. The PLUS programs will prompt you for each color in the proper order.

The VisiCalc programs *themselves* are not interchangeable. This is because of differences in the coding of the programs and in the operating systems of the two computers.

Experienced VisiCalc users will immediately note that more of the worksheet is visible in the larger CRT screen. And the availability of more and larger plug-in memory modules provides you with the use of the entire worksheet, regardless of its contents. For a more detailed explanation of the increased memory capability of HP-86/87 VisiCalc, refer to section 8, The VisiCalc Worksheet and Computer Memory.

All of the prompts are identical in both VisiCalc versions, except that the words which were abbreviated on the HP-83/85 (because of the smaller CRT) are now spelled out on the larger CRT screen. The responses you will be asked to provide are also identical.

New VisiCalc Features

Two of the new features which have been added to VisiCalc are made possible by the abilities of the 80 column CRT screen on your HP-86/87.

The *page size* command (/GP) uses the CRT screen's option to display either 16 or 24 lines. The /GP command is explained in section 6 of this manual, Formatting the Worksheet.

The *background* command (/GB) uses the CRT screen's inverse video character set to change the screen between white letters on a black background and black letters on a white background. The /GB command is also explained in section 6 of this manual.

A new BASIC program, VZWRITE, enables you to create /SS files from data files consisting of single dimension numeric arrays. These files can be created from other HP application pacs. The use of VZWRITE is discussed at the end of section 2, Storing Your Work.

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