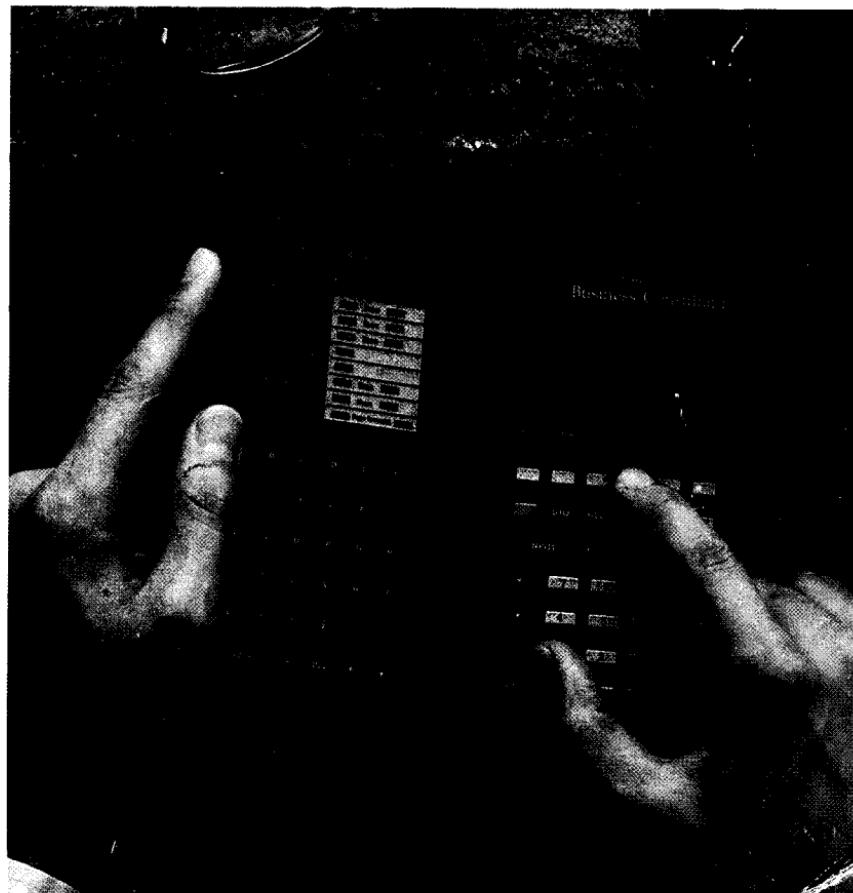


HEWLETT-PACKARD

HP-18C  
Business Consultant  
Owner's Manual



# **HP-18C**

## **Business Consultant**

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### **Owner's Manual**



**HEWLETT  
PACKARD**

Edition 1 April 1986  
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# List of Examples

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## How to Use This Manual

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We know that somewhere out there we could find a few people who are delighted at the prospect of reading an instruction manual cover-to-cover—tables, footnotes, and all. If you are about to immerse yourself in this manual, we wish you happy reading. We've worked diligently to make it a quality work of non-fiction.

Chances are, though, that you are one of the vast majority who likes to learn by seeing what happens when you press keys. The HP-18C has been designed to help you do just that. We've designed the manual to be a companion to this process—something you use to answer particular questions or to guide you through a particular procedure. If you'll be using the manual that way, we have some suggestions to help you learn to use the HP-18C as quickly as possible.

- Take the time to read chapter 1. Chapter 1 gives you an overview of how the HP-18C works, and introduces terms and concepts that are used throughout the manual. After you've read chapter 1, you will be ready to start using all of the calculator's features, reading other portions of the manual when necessary.
- Match the problem you need to solve with the calculator's capabilities. There are several ways to locate information about the HP-18C's features: the table of contents, the subject index, the list of examples, and the menu maps in appendix E.
- Before doing any time-value-of-money problems or cash flow problems, learn how the calculator uses positive and negative numbers in financial calculations. For this information, refer to pages 58 and 83.

After you've used the HP-18C and the manual for a while, please take the time to fill out and mail the self-addressed card labeled "Comments on the HP-18C Owner's Manual." We will benefit from knowing where, in your opinion, we could use some improvement. If you think we've done a good job, we'd like to know that too.

## Starting to Use the HP-18C

### Installing the Batteries

The HP-18C is powered by three N-cell alkaline batteries. Batteries are included with the calculator. If the batteries are not already installed, follow the instructions that start on page 185.

### Turning the HP-18C On and Off

To turn on the calculator, press **ON**. Pressing **ON** again turns the HP-18C off. Since the HP-18C has *Continuous Memory*, turning it off does not affect the information you've stored there.

To conserve energy, the HP-18C turns itself off ten minutes after you stop using it.

If you see the low battery symbol () at the top of the display, you should replace the batteries as soon as possible. Follow the instructions starting on page 185.

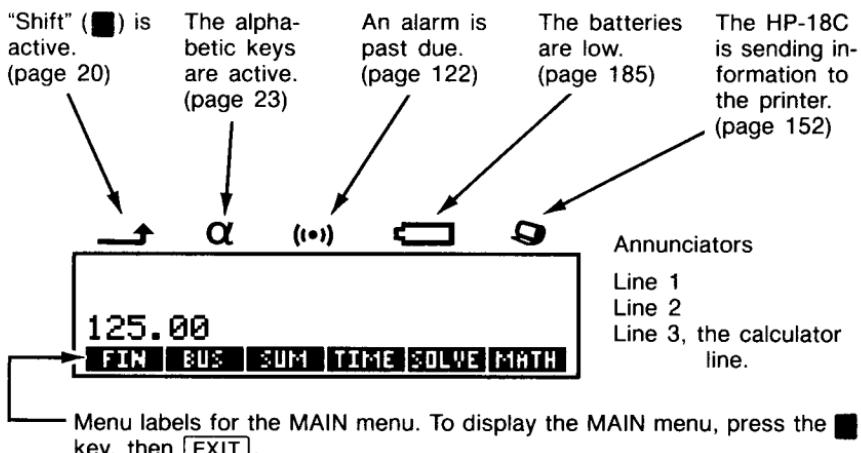
### Setting the Display Contrast

The display brightness and sharpness depend on lighting, your viewing angle, and the display contrast setting. To change the display contrast, hold down the **ON** key while you press **↑** or **↓**.

## Using the Display

Key in the simple addition problem  $25 + 100$  by pressing **2 5 + 1 0 0 =**. Notice how the *cursor* (■) marks the position where the characters are displayed. When you're done, the display should look like the one below, except that the pictures at the top, called annunciators, won't be on.

**Figure 1-1. The Display**



Line 3, the *calculator line*, is used for arithmetic calculations. At times, the calculator line is also used as an edit line. Information you type is displayed on the calculator line, where it can be edited. Then, depending on the type of calculation you are doing, some other key enters that information into the HP-18C.

The contents of lines 1 and 2 depend on the type of calculation you are doing. Sometimes those lines display a history of the previous contents of the calculator line. At other times, lines 1 and 2 display a variety of information, such as results of calculations, lists of numbers, the time and date, and instruction messages.

When you turn the HP-18C on for the first time, numbers are displayed with two decimal places and with a period as the decimal point. You can change the number of decimal places, and you can also interchange the use of commas and periods in numbers (for example, change 1,000.00 to 1.000,00). Refer to pages 43 and 44 for additional information.

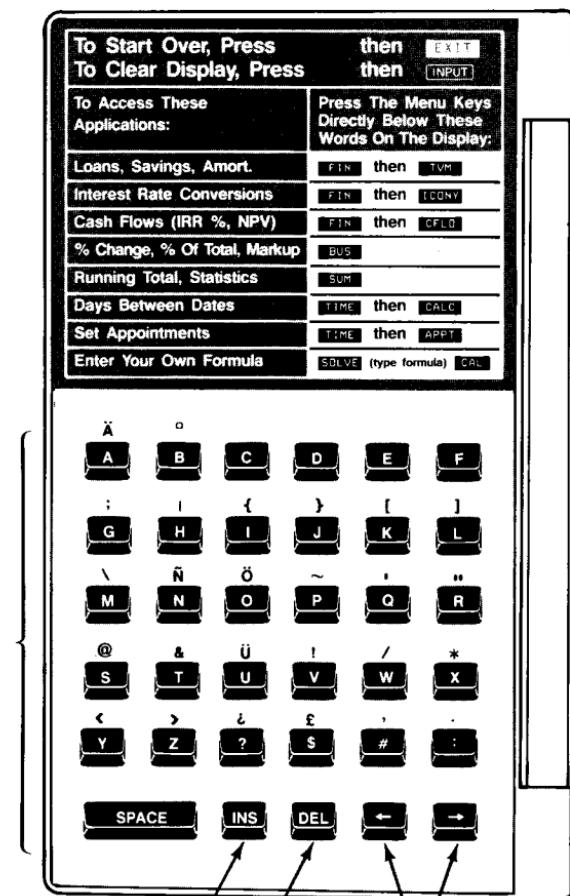
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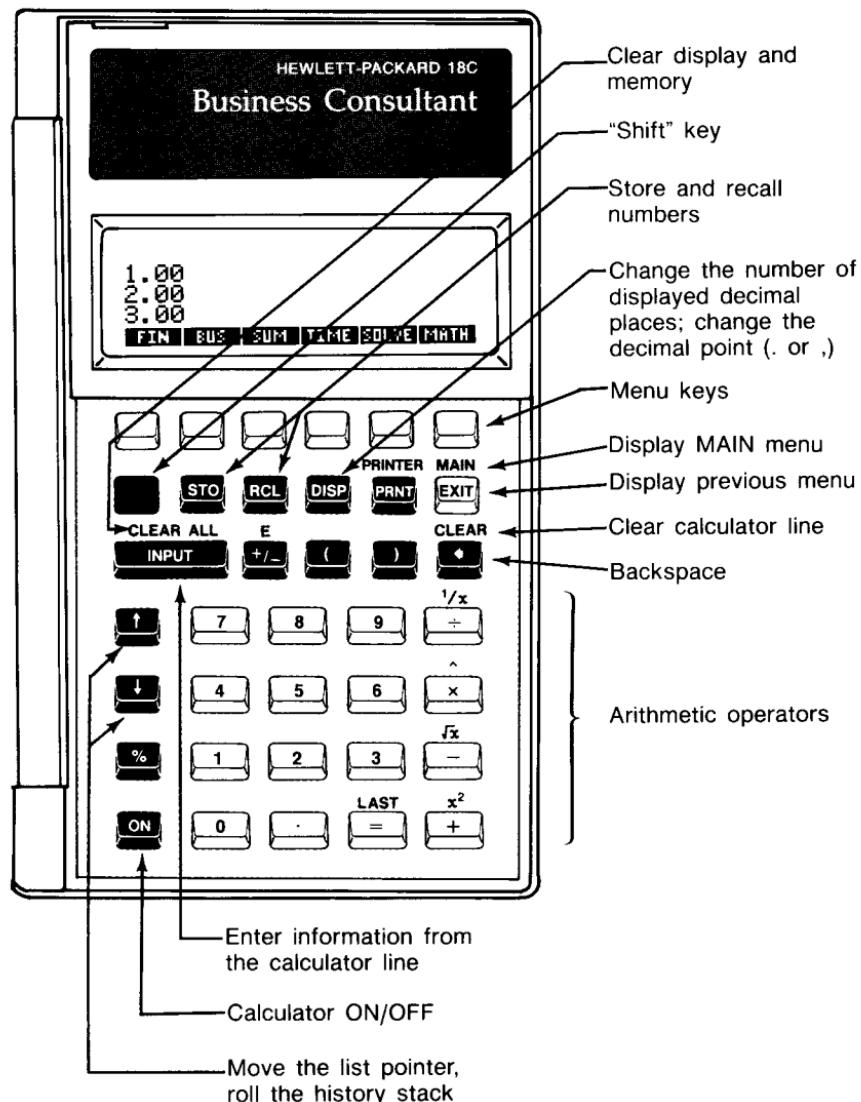
## Using the Keyboard

Figure 1-2 illustrates the HP-18C keyboard and briefly describes the use of many of the keys.

**Figure 1-2. The Keyboard**

Alphabetic keys.  
Your calculator  
keyboard does not  
show the shifted keys  
on this side of the  
keyboard.





Throughout this manual, boxes are used to indicate labeled keyboard keys—for example, [INPUT] and [+]. The blank keys under the display are described according to the labels above the key in the display—for example, {FIN} and {SOLVE}.

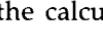
When the HP-18C displays instruction messages, it uses certain symbols to indicate keys. Square brackets indicate the labeled keys—for example, [INPUT] and [+]. Curly braces indicate the blank keys—for example, {FIN} and {SOLVE}.

## The Key

Some of the keys have a second purpose printed in gold above the key. The gold shift key accesses these operations. To do a “shifted” operation, press and release  to turn on the shift annunciator (). Then, press the key. For example, pressing  followed by  (also written  [CLEAR]) clears the calculator line.

If you press  by mistake, press  again to turn off the shift annunciator.

## The Key

The  key is used in certain calculations to enter information from the calculator line into calculator memory. Using  is covered throughout the manual.

---

## Doing Arithmetic

Arithmetic is done on line 3—hence the name *calculator line*. This is a brief introduction to the four operator keys—, , , and .

Arithmetic is covered in greater detail in chapter 2. If you make a typing mistake, use  to backspace to the wrong character.

To add 721.07 and 223.89:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
721.07 $\boxed{+}$ 223.89	721.07 + 223.89	
$\boxed{=}$	944.96	The equals sign completes the calculation.

Once the HP-18C has completed a calculation, pressing another number key starts a new calculation. The display keeps a record of your previous results.

Here are some additional arithmetic problems:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
877.35 $\boxed{-}$		Subtraction.
930.89 $\boxed{=}$	-53.54	
65 $\boxed{\times}$ 12 $\boxed{=}$	780.00	Multiplication.

## Negative Numbers

There are two ways to key in negative numbers:

- Key in the number and then press  $\boxed{+/-}$ .
- If the number follows an operator, you can press  $\boxed{-}$  before keying in the number.

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
75 $\boxed{+/-}$	-75	Changes the sign of 75.
$\div$ 3 $\boxed{=}$	-25.00	Calculates $-75 \div 3$ .
4.52 $\boxed{\times}$ $\boxed{-}$ 7.1 $\div$ 12 $\boxed{=}$	-2.67	$\boxed{-}$ after $\boxed{\times}$ changes the sign of 7.1.

## Using a Result in Another Calculation

As you've seen, pressing a number key when the calculator line contains a result starts a new calculation. If you press an operator key instead, the HP-18C continues the calculation:

Keys:	Display:	Description:
75 $\boxed{+}$ 145 $\boxed{=}$	220.00	Calculates $75 + 145$ .
$\boxed{\div}$ 3.5 $\boxed{=}$	62.86	Divides 220 by 3.5.

The HP-18C lets you do chain calculations (calculations based on the results of previous calculations) without using  $\boxed{=}$  at the conclusion of each step. Chapter 2 shows you how to do this.

## Editing and Clearing the Calculator Line

The cursor is visible when you are in the process of keying in a number or doing a calculation. When the cursor is visible, pressing  $\boxed{\leftarrow}$  deletes the last character you keyed in. When the cursor is not visible, pressing  $\boxed{\leftarrow}$  erases the rightmost number.

To clear the calculator line to 0.00, press  $\boxed{\text{CLEAR}}$ .

Keys:	Display:	Description:
12345 $\boxed{\leftarrow}$ $\boxed{\leftarrow}$		Edits the calculator line.
.66	123.66	
$\boxed{+}$ 18.95 $\boxed{=}$	142.61	Calculates $123.66 + 18.95$ .
$\boxed{\text{CLEAR}}$	0.00	Clears the calculator line

## The History Stack

Notice how lines 3, 2, and 1 show the results of the current calculation and the two that preceded it. This record of your activities is called the *history stack*.

**Figure 1-3. The History Stack**



Since the HP-18C uses the display for a variety of purposes, sometimes the history stack is replaced by other information. Using the history stack is covered on page 37.

## Clearing the Display

Pressing **■ [CLEAR ALL]** clears the history stack. Sometimes, **■ [CLEAR ALL]** has other functions. Refer to page 31 for additional information about **■ [CLEAR ALL]**.

---

## Using the Alphabetic Keys

There are a number of situations where the HP-18C requires you to type alphabetic information into line 3. When line 3 is being used to type in alphabetic information, the alphabetic annunciator (**a**) comes on. The editing keys described in table 1-1 are active when the alphabetic annunciator is on.

**Table 1-1. Alphabetic editing keys.**

Key	Description
	Backspace; erases the character to the left of the cursor.
[CLEAR]	Clears the calculator line.
	Moves the cursor one space to the left.
[←]	Moves the cursor to the first character on the line.
	Moves the cursor one space to the right.
[→]	Moves the cursor to the end of the line.
	Inserts one blank space at the cursor position, into which you can type a character.
	Deletes the character at the cursor position.

The keyboard illustration on page 18 shows shifted alphabetic characters that aren't printed on the keyboard. You can use these characters as you would any other alphabetic character.

If you press an alphabetic key when the **(A)** annunciator is not on, the HP-18C displays:

PRESS EXIT, OR TYPE A  
MESSAGE & PRESS [PRNT]



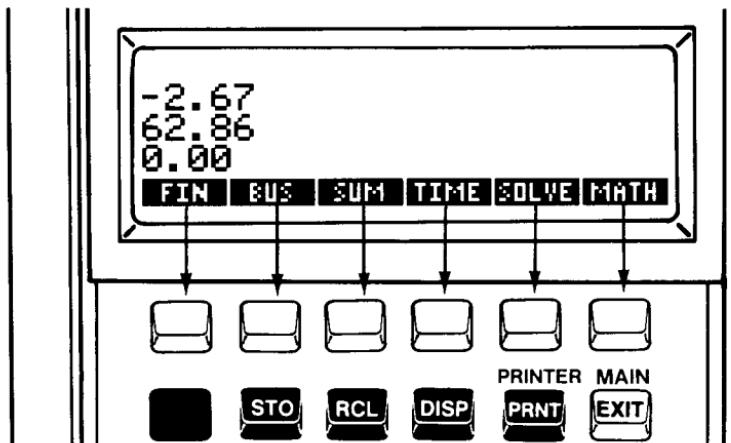
If you have the printer designed for use with the HP-18C, you can now print a message (refer to page 156 for additional information). Otherwise, you should press **EXIT** to erase the message.

Using the alphabetic keys is covered throughout the manual, as necessary.

## Using the Menu Keys

The six blank keys at the top of the keyboard and six labels on the bottom line of the display are related to one another. The labels tell you what the keys do. The labels are on the display, rather than on the keys themselves, because the keys do different things at different times. The six keys are called *menu keys*; the labels are called *menu labels*.

**Figure 1-4. Menu Keys and Menu Labels**



Depending on what calculations you are doing, the HP-18C displays a particular set of labels, called a *menu*. The menu presents the choices of what you can do next.

### The MAIN Menu

No matter which menu you are currently using, pressing **[MAIN]** displays the **MAIN** menu. The **MAIN** menu is a set of primary choices. Starting from the **MAIN** menu, you can eventually display any other menu. Table 1-2 describes the types of operations done within each major category.

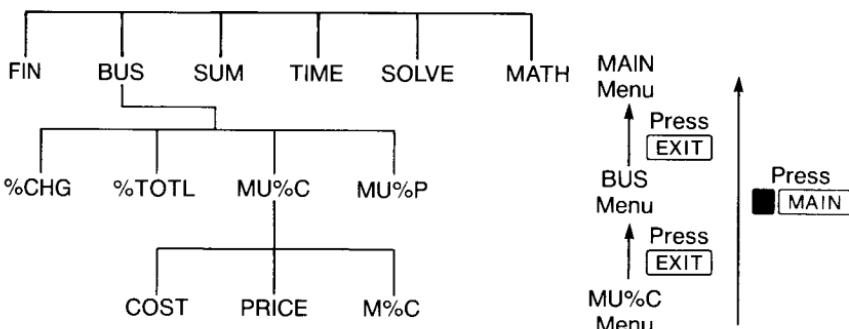
**Table 1-2. The MAIN Menu**

Menu Key	Operations Done in This Category	Covered in:
<b>FIN</b> (Finance)	Time-value-of-money (loans, savings, leasing, interest conversions).  Cash flows, internal rate of return, net present value.	Chapter 4  Chapter 5
<b>BUS</b> (General Business)	Percent of total, percent change, markup on cost, markup on price.	Chapter 3
<b>SUM</b>	Running totals, statistics, curve fitting, forecasting.	Chapter 6
<b>TIME</b> (Time manager)	Clock, calendar, alarms, date arithmetic.	Chapter 8
<b>SOLVE</b> (Formula Solver)	Creating and using your own (custom) menus for calculations.	Chapter 9
<b>MATH</b>	Math functions	Chapter 2

## Changing Menus and Reading Menu Maps

Figure 1-5 is a *menu map* illustrating three menus. The top row is the MAIN menu. Pressing the **BUS** key displays the BUS (general business) menu. Then, pressing **MU%C** displays the MU%C (markup as percent of cost) menu. There are no menus that branch from the MU%C menu because the MU%C menu is a final destination—you use it to do calculations, rather than to choose another menu.

**Figure 1-5. A Menu Map.**



In addition to pressing menu keys, there are two other ways to switch menus:

- Press **EXIT** to return to the previous menu.
- Press **MAIN** to return to the MAIN menu.

When a menu has more than six labels, a menu key labeled **MORE** is used to switch between sets of labels.

**Example: Using menus.** Use figure 1-5 as you follow along in this example. The example calculates the percent markup on cost of a crate of oranges that a grocer buys for \$4.10 and sells for \$4.60.

**Step 1** Decide which menu you want to use. The MU%C (markup as a percent of cost) menu is our destination. If it's not obvious to you which menu you need, look up the topic in the subject index and examine the menu maps in appendix E.

**Displaying the MU%C menu:**

**Step 2** To display the MAIN menu, press **MAIN**. This step isn't always necessary, but it is useful when you want to start from a known location on the menu map.

**Step 3** Press **BUS** to display the BUS (general business) menu.

**Step 4** Press **MU%C** to display the MU%C menu.

### **Using the MU%C menu:**

**Step 5**      Press **CLEAR ALL** to clear the history stack and set the (Optional)\* values of COST, PRICE, and M%C to 0.

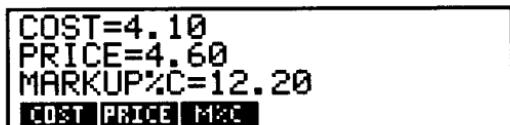
**Step 6**      Key in 4.10 and press **COST**. This stores 4.10 as the COST.

**Figure 1-6. Storing the COST**



**Step 7**      Key in 4.60 and press **PRICE** to store 4.60 as the PRICE.

**Figure 1-7. Calculating the Markup as a Percent of Cost**



**Step 8**      Press **M%** to calculate the markup as a percent of cost. The answer:  $\text{MARKUP\%C}=12.20$ .

**Step 9**      To leave the MU%C menu, press **EXIT** (to display the BUS menu) or **MAIN** (to display the MAIN menu).

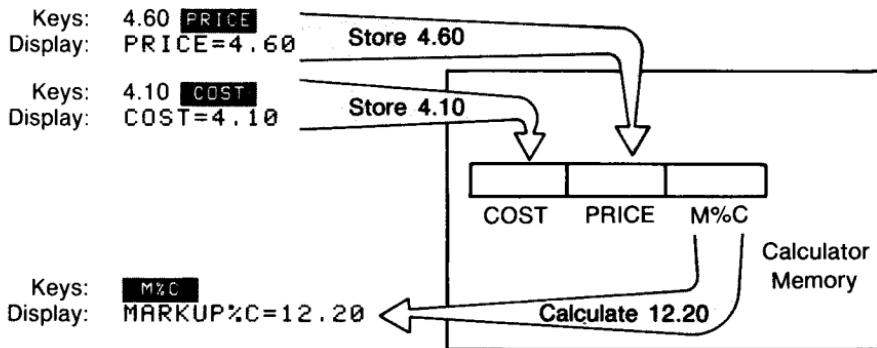
\* This step is optional because COST, PRICE, and M%C are cleared whenever you press **BUS** to display the BUS menu. However, since you may not always return to the MAIN menu between calculations, you may want to get into the habit of clearing before starting a new calculation.

## Doing Calculations Using Menus

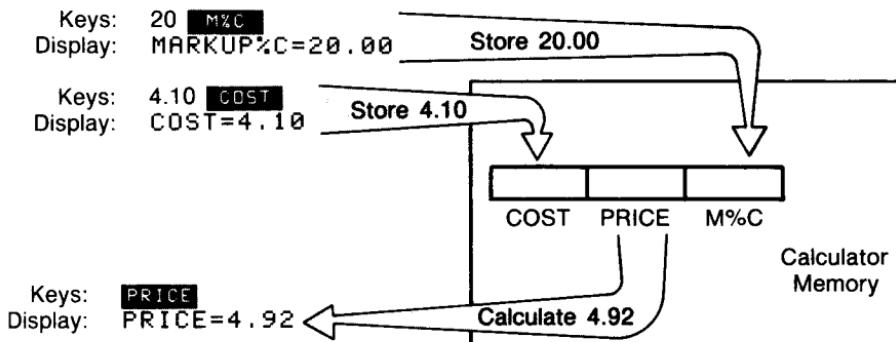
Many menus do calculations in much the same way as the previous markup calculation. You use the menu keys both to store numbers used in the calculations and to do the calculations.

Figure 1-8 illustrates using the MU%C menu to calculate the percent markup on cost. Figure 1-9 shows another calculation using the MU%C menu. This time, the calculation uses the COST and M%C to calculate the PRICE.

**Figure 1-8. Calculating M%C**



**Figure 1-9. Calculating the PRICE**



Notice that the two calculations use the same three storage locations; each location is used both to store and to calculate values. These storage locations are called *built-in variables*, because they are permanently built into the HP-18C, and because their contents vary as you store and calculate different numbers.

The rules for using variables are:

- **To store a value**, key in the number and press the menu key.\* If you haven't just keyed in a number (for example, you've just switched menus and you want to store the number already in the calculator line), press **STO** followed by the menu key.<sup>†</sup>
- **To calculate a value**, press the menu key without first keying in a number. In other words, when you press two menu keys one after another, the second key does a calculation. The HP-18C displays **CALCULATING...** when a value is being calculated.
- **To display a value**, press **RCL** followed by the menu key. For example, **RCL COST** displays the value stored in COST.
- **To clear all the variables in a menu**, press **CLEAR ALL** while the menu is displayed. This also clears the history stack. Clearing a menu is useful when you want to start a new calculation without worrying about what numbers may have previously been stored.

---

## Making a Graceful **EXIT**

The **EXIT** key is used to switch to the previously displayed menu. One particularly important use of **EXIT** is for backing out of a mistake made while switching menus. For example, if you accidentally pressed **MU%P** in the **BUS** menu when you meant to press **MU%C**, pressing **EXIT** would return you to the place where you made the mistake—the **BUS** menu.

\* An incomplete arithmetic calculation is completed. For example,  $2 \times 50$  **COST** stores 100 in COST.

<sup>†</sup>If the calculator line contains two or more numbers, **STO** menu key stores only the rightmost number into the variable. For example,  $2 \times 50$  **STO COST** stores 50 in COST.

---

## **Clearing the Display and Menu Variables**

The **CLEAR ALL** key is a powerful clearing feature:

- Pressing **CLEAR ALL** always clears the history stack.
- If the current menu consists of variables (for example, COST, PRICE, and M%C in the MU%C menu), those variables are cleared to 0.
- If the HP-18C is displaying a number list or formula list, **CLEAR ALL** clears all the information from the list. Clearing number lists is covered in chapter 7; clearing the formula list is covered in chapter 9.

---

## **When the HP-18C Doesn't Understand What You Want**

Suppose you tried to calculate the markup on cost without storing a value for COST. COST would have a value of 0, and the calculator would be unable to do the calculation. To help you correct the situation, the HP-18C beeps and displays a message. The message is erased from the display the next time you press a key.

Refer to appendix C for additional information about error messages.

---

## **Custom Menus**

The HP-18C has a set of built-in formulas used by some of its menus. For instance, the markup calculations on the previous pages use a formula stored permanently in calculator memory.

The HP-18C lets you enter your own formulas into memory, which are then used to create menus customized for your particular needs—*custom menus*. Creating and using custom menus is done by the *formula solver*, which is covered in chapter 9.

---

## How to Use and Reuse Calculator Memory

The HP-18C lets you store many different types of information in calculator memory. Each piece of information requires a certain amount of storage space. Eventually, you may see the message:

### INSUFFICIENT MEMORY

If you encounter this message, you will have to erase previously stored information before you can store any new information. The types of information that use calculator memory, and the amount of memory they use, are covered in the section **Managing Calculator Memory** on page 189.

In addition to erasing portions of memory, the HP-18C allows you to erase all the information you've stored inside the calculator. This is covered in the section **Erasing Continuous Memory** on page 188.

# 2

## Arithmetic

---

### Introduction

Chapter 1 introduced you to using the calculator line for doing simple arithmetic. Chapter 2 contains additional information on doing arithmetic calculations.

---

### Using the Calculator Line

You can use the calculator line (line 3) to do arithmetic calculations at any time, except when the alphabetic annunciator (**A**) is on. Sometimes the HP-18C displays letters on the calculator line, even though the alphabetic annunciator is off. For example, the calculator line might contain:

TOTAL=124.60

Then, pressing **[+]** 2 **[=]** would calculate 124.60 plus 2, and the HP-18C would display the answer, 126.60.

---

### Simple Arithmetic

Here are some examples of simple arithmetic using the keys **[+]**, **[-]**, **[x]**, **[÷]**, and **[y<sup>x</sup>]** (**[y<sup>x</sup>]** raises a number to a power). Notice how the **[=]** key completes the calculation. You can also use **[INPUT]** to complete calculations.\*

\* If the HP-18C is displaying the CFLO or SUM menu, **[INPUT]** causes the result of the calculation to be entered into the number list.

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
54.69 $\boxed{+}$ 28.33 $\boxed{=}$	83.02	
750 $\boxed{\times}$ 12 $\boxed{=}$	9,000.00	Pressing a number key after $\boxed{=}$ starts a new calculation.
1.08 $\boxed{\Box}$ $\boxed{\wedge}$ 5 $\boxed{=}$	1.47	Calculates $1.08^5$ .

---

## Chain Calculations

Chain calculations involve doing more than one operation at a time. Here's one type of chain calculation, based on the previous example:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
750 $\boxed{\times}$ 12 $\boxed{=}$	9,000.00	Pressing a number key after $\boxed{=}$ in the previous example starts a new calculation.

Now see what happens when you press an operator key after  $\boxed{=}$ .

$\boxed{+}$ 360 $\boxed{=}$	25.00	The calculation continues, using the results of the previous calculation.
-----------------------------	-------	---

There's an easier way to do the calculation  $\frac{750 \times 12}{360}$ :

750 $\boxed{\times}$ 12 $\boxed{\div}$	9,000.00 $\div$	You don't need to press $\boxed{=}$ . The HP-18C displays the intermediate answer.
360 $\boxed{=}$	25.00	Press $\boxed{=}$ to complete the calculation.

Here's a longer chain calculation.

$$\frac{456 - 75}{18.5} \times \frac{68}{1.509}$$

Watch what happens in the display as you key it in:

456	[ $-$ ]	75	[ $\div$ ]	381.00 $\div$
18.5	[ $\times$ ]			20.59 $\times$
68	[ $\div$ ]			1,400.43 $\div$
1.509	[ $=$ ]			928.05

---

## Percent

In most cases, [%] divides the number furthest to the right by 100. The one exception is when a plus or minus sign precedes the number. Then, the [%] key uses the rightmost number as a percent, and calculates that percent of the number preceding the plus or minus sign.

Find 27% of 85.3.

Keys:	Display:	Description:
85.3 [ $\times$ ] 27 [%]	85.30 $\times$ 0.27	Divides 27 by 100.
[ $=$ ]	23.03	Calculates 27% of 85.3

Calculate the number that is 10% greater than 25.

25 [ $+$ ] 10 [%]	25.00+2.50	Calculates 10% of 25.
[ $=$ ]	27.50	Completes the calculation.

**Example: Calculating simple interest.** You borrow \$1,250 from a relative, and agree to repay the loan in a year with 7% simple interest. How much money will you owe?

Keys:	Display:	Description:
1250 [+] 7 [%]	1,250+87.50	Interest on the loan is \$87.50.
[=]	1,337.50	You must repay this amount at the end of one year.

---

## Other Keyboard Arithmetic

The other keyboard arithmetic keys are  $\boxed{\text{[} \text{/} \text{x]}}$ ,  $\boxed{\text{[} \sqrt{\text{x}} \text{]}}$ , and  $\boxed{\text{[} \text{x}^2 \text{]}}$ . They act on the number furthest to the right.

Keys:	Display:	Description:
4 $\boxed{\text{[} \text{/} \text{x]}}$	0.25	Calculates the reciprocal of 4.
20 $\boxed{\text{[} \sqrt{\text{x}} \text{]}}$ [+]		Calculates $\sqrt{20}$ .
47.2	4.47 + 47.2	
[x]	51.67 ×	Calculates 4.47 + 47.20.
1.1 $\boxed{\text{[} \text{x}^2 \text{]}}$	51.67 × 1.21	Calculates $1.1^2$ .
[=]	62.52	Completes the calculation.
125 <sup>^</sup> 3		Calculates the cube root of 125.
$\boxed{\text{[} \text{/} \text{x]}}$ [=]	5.00	

---

## Using Parentheses in Calculations

Use parentheses when you need to postpone calculating an intermediate result until you've entered more numbers. For example, suppose you want to calculate:

$$\frac{30}{85 - 12} \times 9$$

If you were to key in  $30 \div 85 -$ , the HP-18C would calculate the intermediate result, 0.35. However, that's not what you want. To delay the division until you've subtracted 12, use parentheses:

Keys:	Display:	Description:
$30 \div \text{[}] 85 \text{ [}-$	$30.00 \div (85.00 -$	No calculation is done.
$12 \text{ [] }$	$30.00 \div 73.00$	Calculates $85 - 12$ .
$\text{[x]} 9$	$0.41 \times 9$	Calculates $30 / 73$ .
$\text{[=]}$	$3.70$	Calculates $0.41 \times 9$ .

---

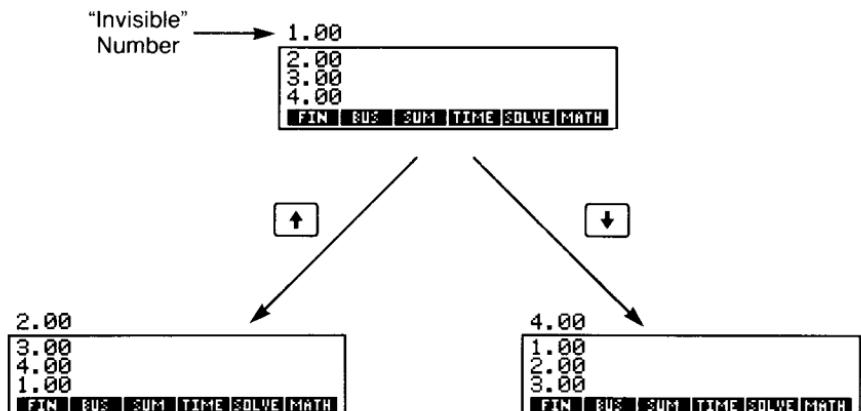
## Recalling Numbers to the Calculator Line

Sometimes, you may want to include the result of a previous calculation in a new calculation. There are several ways to reuse numbers.

### Using the History Stack

When you start a new operation on the calculator line, the previous contents moves to line 2, and eventually, to line 1. Lines 1, 2, and 3 display three lines of the *history stack*—a record of activities.

**Figure 2-1. The History Stack**



The  $\downarrow$  and  $\uparrow$  keys “roll” the history stack down or up one line. You cannot roll the history stack when there is an incomplete calculation in the calculator line.

The history stack can contain up to four numbers—the three visible numbers and the last number that rolled up off the top of the display. Pressing  $\downarrow$  brings the number back down. Also, if you hold down  $\uparrow$  or  $\downarrow$ , you’ll see that the history stack wraps around on itself.

The top three numbers in the history stack are automatically cleared whenever you switch menus; the number on the calculator line is retained so that you can use it in other calculations.

Pressing  $\boxed{\text{CLEAR ALL}}$  clears the history stack, and sometimes also clears other information from calculator memory. Refer to page 31 for additional information about  $\boxed{\text{CLEAR ALL}}$ .

Keys:	Display:	Description:
75.55 $\boxed{-}$ 32.63		
$=$	42.92	
150 $\div$ 7 $=$	21.43	42.92 moves to line 2.

Now, suppose you want to multiply  $42.92 \times 11$ . Using the history stack saves you time.

<input type="button" value="↓"/>	42.92	Moves 42.92 back to the calculator line.
<input type="button" value="x"/> 11 <input type="button" value="="/>	472.12	

## The Key

The  key copies the number in line 2 into a calculation you are in the process of doing.

For example, here is one way to calculate  $\frac{39 + 8}{\sqrt{123 + 17}}$

Keys:	Display:	Description:
123 <input type="button" value="+"/> 17 <input type="button" value="="/>	140.00	Calculates $123 + 17$ .
<input type="button" value="LAST"/> <input type="button" value="√x"/>	11.83	Calculates $\sqrt{140}$ .
39 <input type="button" value="+"/> 8 <input type="button" value="+"/> <input type="button" value="LAST"/>	47.00 ÷ 11.83	Copies 11.83 to the calculator line.
<input type="button" value="="/>	3.97	Completes the calculation.

## Using Registers

The  key copies a number from the calculator line to a designated storage area, called a register. There are four registers in calculator memory, numbered 0, 1, 2 and 3. The  key recalls stored numbers back to the calculator line.

If there is more than one number on the calculator line,  copies only the rightmost number.

To store or recall a number using a register:

1. Press **STO** or **RCL**.
2. Key in 0, 1, 2, or 3.

To cancel the store or recall after you've pressed **STO** or **RCL**, press **◀**.

The following keystrokes do these two calculations using two registers.

$$\begin{array}{r} 475.6 \\ - 39.15 \end{array}$$

$$\begin{array}{r} 560.1 + 475.6 \\ - 39.15 \end{array}$$

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
475.6 <b>STO</b> 1	475.60	Stores 475.6 into register 1.
<b>+ 39.15 STO</b> 2	475.60 ÷ 39.15	Stores 39.15 (the rightmost number) into register 2.
<b>=</b>	12.15	Completes the calculation $475.60 / 39.15$ .
<b>560.10 +</b> <b>RCL 1</b>	560.10 + 475.60	Recalls the contents of register 1.
<b>÷ RCL 2</b>	1035.70 ÷ 39.15	Recalls the contents of register 2.
<b>=</b>	26.45	Completes the calculation.

The **STO** and **RCL** keys can also be used with variables. For example, **STO M%C** (in the MU%C menu) stores the rightmost number in the calculator line into the variable M%C. **RCL M%C** copies the contents of M%C into the calculator line.

## Doing Arithmetic Inside Registers

The HP-18C lets you do arithmetic on numbers in registers. The following example stores 45.7 in register 3, multiplies that number by 2.5, and stores the result back in register 3:

Keys:	Display:	Description:
45.7 [STO] 3	45.70	Stores 45.7 into register 3.
2.5 [STO] [x] 3	2.50	Stores $114.25$ $(45.7 \times 2.5)$ into register 3.
[RCL] 3	114.25	Displays the contents of register 3.

**Table 2-1. Arithmetic in Registers**

Keys	New Number in Register
[STO] [+]	old number + displayed number
[STO] [-]	old number - displayed number
[STO] [x]	old number $\times$ displayed number
[STO] [ $\div$ ]	old number $\div$ displayed number
[STO] [ $\wedge$ ]	old number $^{\wedge}$ displayed number

You can also do arithmetic on numbers stored in variables. For example, 2 [STO] [x] [M%C] (in the MU%C menu) multiplies the current contents of M%C by 2 and stores the product in M%C.

---

## The MATH Menu Functions

Six math operations are available using the MATH menu. To display the MATH menu, press **MATH** in the MAIN menu. Except for **PI**, these keys use the number furthest to the right in the calculator line.

**Table 2-2. The MATH Menu Keys**

Menu Key	Description
<b>LOG</b>	Common (base 10) logarithm of a positive number.
<b>10<sup>X</sup></b>	Common (base 10) antilogarithm; calculates $10^X$ .
<b>LN</b>	Natural (base e) logarithm of a positive number.
<b>EXP</b>	Natural antilogarithm; calculates $e^X$ .
<b>N!</b>	Factorial.
<b>PI</b>	Displays $\pi$ (3.14159265359) in the current display format.

Starting from the MAIN menu:

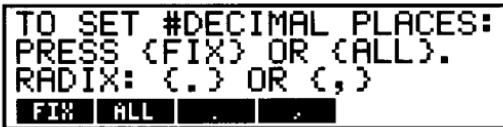
Keys:	Display:	Description:
2.5 <b>MATH</b>		Calculates $10^{2.5}$ .
<b>10<sup>X</sup></b>	316.23	
790 <b>[+]</b> 4		Calculates the factorial of 4.
<b>N!</b>	790.00+24.00	
<b>=</b>	814.00	Completes the calculation.

# Changing the Number of Displayed Decimal Places

To change the number of displayed decimal places:

1. Press **DISP** to display the DISP menu.

**Figure 2-3. The DISP Menu**



2. Do **a** or **b**:

- To specify the number of displayed decimal places, press **FIX**. Type the number of decimal places (an integer from 0 to 11) and press **INPUT**.
- To display numbers as precisely as possible (up to a maximum of 12 digits), press **ALL**.

Changing the number of displayed decimal places affects what you see, but doesn't affect internal calculations. Internally, the HP-18C does calculations with 12-digit numbers.\*

Starting with two displayed decimal places:

Keys:	Display:	Description:
45 <b>x</b> .1256 <b>=</b>	5.65	Two decimal places are displayed.
<b>DISP FIX</b>	5.6520	Four decimal places are displayed.
<b>DISP ALL</b>	5.652	Trailing zeros are dropped.
<b>DISP FIX 2</b> <b>INPUT</b>	5.65	Two decimal places are displayed.

\* An exception is values of PV, PMT, and INT used in amortization calculations (refer to **Amortization** on page 66), which are rounded to the display setting.

---

## Interchanging the Period and Comma in Numbers

To change the decimal point and digit separator:

1. Press [DISP] to display the DISP menu.
2. Specify the decimal point by pressing [.] or [,]. [.] sets a period as the decimal point and comma as the digit separator. For example, the number one million is displayed as 1,000,000.00. [,] sets a comma as the decimal point and period as the digit separator. For example, the number one million is displayed as 1.000.000,00.

---

## Scientific Notation

Scientific notation is useful when you are working with very large or very small numbers. For example, the 1984 Gross National Product of the United States was \$3,662,800,000,000. Scientific notation writes this number as a smaller number (called a mantissa) times 10 raised to a power. In this case, the decimal point is moved 12 places to the left, and the number is written as  $3.6628 \times 10^{12}$ . The same process is used for very small numbers, except that the decimal point is moved to the right, and 10 is raised to a negative power. For example, 0.00000752 can be written as  $7.52 \times 10^{-6}$ .

When a calculation produces a result too large or too small for the HP-18C to display, the number is automatically displayed in scientific notation, using a capital E in place of " $\times 10^n$ ".

To key in numbers in scientific notation:

1. Key in the mantissa. If the mantissa is negative, use  $\text{[+/-]}$  to change the sign.
2. Press either the alphabetic  $\text{[E]}$  or  $\text{[LN]}$  to start the exponent.
3. If the exponent is negative, press  $\text{[-]}$ .
4. Key in the exponent.

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
4.78 $\text{[E]}$ 13 $\text{[+/-]}$ 8 $\text{[E]}$ 25 $\text{[=]}$	5.98E-13	$4.78 \times 10^{13} \div 8 \times 10^{25}$ equals $5.98 \times 10^{-13}$ .
2.36 $\text{[+/-]}$ $\text{[LN]}$ $\text{[E]}$ $\text{[-]}$ 15 $\text{[x]}$ 12 $\text{[=]}$	-2.83E-14	$-2.36 \times 10^{-15} \times 12 =$ $-2.83 \times 10^{-14}$ .

# 3

## General Business Calculations

### Introduction

The general business (BUS) menu is used to solve four types of problems. Each type of problem has its own menu.

Percent change (%CHG)	The difference between two numbers, expressed as a percentage of one of the numbers.
Percent of total (%TOTL)	The portion that one number is of another, expressed as a percentage.
Markup on cost (MU%C)	The difference between price and cost, expressed as a percentage of the cost.
Markup on price (MU%P)	The difference between price and cost, expressed as a percentage of the price.

### Percent Change

You can calculate any one of the three values if you know the other two. The percent change (%CHG) is expressed as a percentage of the OLD number.

1. To display the %CHG (percent change) menu from the MAIN menu, press **BUS**, then **%CHG**.

**Figure 3-1. The %CHG Menu**



2. Store each of the values you know by keying in the number and pressing the appropriate menu key.
3. Press the menu key for the value you want to calculate. The answer is displayed in the calculator line.

**Example: Calculating the percent change.** **Part 1.** Total sales last year were \$110,000. This year, sales were \$115,000. What is the percent change between last year's sales and this year's?

**Part 2.** What would this year's sales have to be to show a 12% increase from last year?

Starting from the MAIN menu:

Keys:	Display:	Description:
BUS <b>%CHG</b>		Displays the %CHG menu.
<b>CLEAR ALL</b>	0.00	Clears the history stack and the %CHG variables.
110000 <b>OLD</b>	OLD=110,000.00	Stores 110,000 in OLD.
115000 <b>NEW</b>	NEW=115,000.00	Stores 115,000 in NEW.
<b>%CH</b>	%CHANGE=4.55	Calculates the percent change.
<b>12 %CH</b>	%CHANGE=12.00	Stores 12 in %CH.
<b>NEW</b>	NEW=123,200.00	Calculates the value 12% greater than 110,000.

## Percent of Total

You can calculate any one of the three values if you know the other two.

1. To display the %TOTL (percent of total) menu from the MAIN menu, press **BUS**, then **%TOTL**.

**Figure 3-2. The %TOTL Menu**



2. Store each of the values you know by keying in the number and pressing the appropriate menu key.
3. Press the menu key for the value you want to calculate. The answer is displayed on the calculator line.

**Example: Calculating the percent of total. Part 1.** Total assets for Evett Company are \$675,840. The firm has inventories of \$234,576. What percentage of total assets is inventory?

**Part 2.** Last year, Evett Company incurred salary expenses that were 45% of operating expenses. If operating expenses were \$76,249, what were salary expenses?

Starting from the MAIN menu:

Keys:	Display:	Description:
<b>BUS</b> <b>%TOTL</b>		Displays the %TOTL menu.
		Clears the history stack and the %TOTL variables.
675840 <b>TOTAL</b>	<b>TOTAL=675,840.00</b>	Stores \$675,840 in TOTAL.

234576	<b>PART</b>	PART=234,576.00	Stores \$234,576 in PART.
	<b>%T</b>	%TOTAL=34.71	Calculates the percent of total.
<b>Part 2:</b>			
	<b>CLEAR ALL</b>	0.00	Clears the history stack and the %TOTL variables.
45	<b>%T</b>	%TOTAL=45.00	Stores 45 in %T.
76249	<b>TOTAL</b>	TOTAL=76,249.00	Stores 76,249 in TOTAL.
	<b>PART</b>	PART=34,312.05	Calculates 45% of the total.

## Markup on Cost

You can calculate any of the three values if you know the other two.

1. To display the MU%C (markup on cost) menu from the MAIN menu, press **BUS**, then **MU%C**.

**Figure 3-3. The MU%C Menu**



2. Store each of the values you know by keying in the number and pressing the appropriate menu key.
3. Press the menu key for the value you want to calculate. The answer is displayed on the calculator line.

**Example: Markup on cost calculations.** The standard markup on blouses at Marcia's Boutique is 60%. The boutique just received a shipment of blouses costing \$19.00 each. What is the retail price per blouse?

Starting from the MAIN menu:

Keys:	Display:	Description:
BUS MU%C		Displays the MU%C menu.
CLEAR ALL	0.00	Clears the history stack and the MU%C variables.
19 COST	COST=19.00	Stores the cost.
60 M%C	MARKUP%C=60.00	Stores 60% in M%C.
PRICE	PRICE=30.40	Calculates the price.

---

## Markup on Price

You can calculate any one of the three values if you know the other two.

1. To display the MU%P (markup as a percent of price) menu from the MAIN menu, press **BUS**, then **MU%P**.

**Figure 3-4. The MU%P Menu**



2. Store each of the values you know by keying in the number and pressing the appropriate menu key.
3. Press the menu key for the value you want to calculate. The answer is displayed in the calculator line.

**Example: Calculating the markup as a percent of price.**

**Part 1.** Henderson's Electronics purchases televisions for \$225, with a discount of 4%. The televisions are sold for \$300. What is the markup as a percent of the selling price?

**Part 2.** What is the markup as percent of price without the 4% discount?

Starting from the MAIN menu:

Keys:	Display:	Description:
<b>BUS MU%P</b>		Displays the MU%P menu.
<b>CLEAR ALL</b>	0.00	Clears the history stack and the MU%P variables.
225 <b>-</b> 4 <b>%</b>		Calculates and stores the net cost.
<b>COST</b>	COST= 216.00	
300 <b>PRICE</b>	PRICE= 300.00	Stores 300 in PRICE.
<b>M%P</b>	MARKUP%P=28.00	Calculates the markup as a percent of price.

**Part 2:** Use \$225 for the cost.

225 <b>COST</b>	COST=225.00	Stores 225 in COST.
<b>M%P</b>	MARKUP%P=25.00	Calculates the markup as a percent of price.

---

## Clearing the BUS Variables

Clearing variables sets them equal to 0.

To clear the variables used by any of the BUS menus, display the menu and press **CLEAR ALL**. For example, pressing **CLEAR ALL** while in the %CHG menu clears OLD, NEW, and %CH. Clearing COST or PRICE in the MU%C or MU%P menu clears the value in both menus.

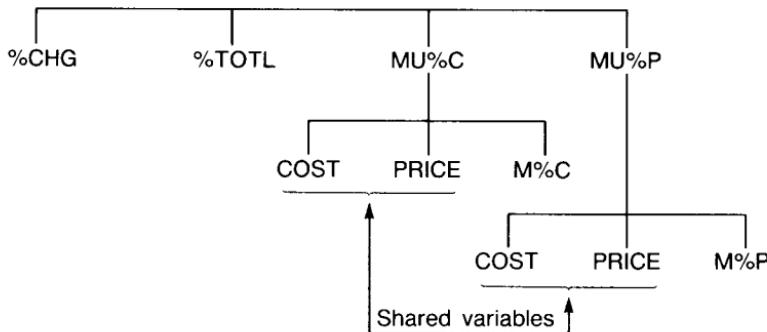
All the variables used by the four BUS menus are cleared when you press **BUS** to display the BUS menu.

---

## Sharing Variables Between Menus

If you compare the MU%C menu and the MU%P menus, you'll see that they have two menu labels in common—**COST** and **PRICE**:

**Figure 3-5. Shared Variables.**



The HP-18C keeps track of the values you key in according to those labels. For example, if you key in a COST and PRICE in the MU%C menu, exit to the BUS menu, and then display the MU%P menu, the HP-18C retains those values. In other words, the variables are *shared* between the two menus.

**Example: Using shared variables. Part 1.** Fredriksen's Food Co-operative buys cases of canned soup with an invoice cost of \$9.60 per case. If Fredriksen's routinely uses a 15% markup on cost, for what price should it sell a case of soup?

**Part 2.** What is the markup on price?

Starting from the MAIN menu:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
<b>BUS MU%C</b>		Displays the MU%C menu.
<b>CLEAR ALL</b>	<b>0 . 00</b>	Clears the history stack and the MU%C variables.
<b>9.60 COST</b>	<b>COST=9 . 60</b>	Stores 9.60 in COST.
<b>15 M%C</b>	<b>MARKUP%C=15 . 00</b>	Stores 15% in M%C.
<b>PRICE</b>	<b>PRICE=11 . 04</b>	Calculates the retail price per case.

**Part 2:**

<b>EXIT</b>		Exit the MU%C menu and enter the MU%P menu.
<b>MU%P</b>		
<b>M%P</b>	<b>MARKUP%P=13 . 04</b>	Calculates the markup as a percent of price.

## Time Value of Money

### Introduction

The phrase *time value of money* describes calculations based on money earning interest over a period of time. There are two types of interest:

- In *simple interest* calculations, the amount of interest is a percent of the principal and is repaid in a lump sum. For example, if you lend a friend \$500.00 for a year and you want to be repaid with 6% simple interest per year, your friend owes you  $\$500 + (\frac{6}{100} \times \$500) = \$530$ . Simple interest calculations can be done using the calculator line and the  $\%$  key. Refer to page 36.
- *Compound interest* calculations take into account that interest, added to the principal at specified *compounding periods*, also earns interest. Many time value of money problems—for example, savings accounts, mortgages, pension funds, leases, and annuities—are compound interest calculations. Amortization calculations determine the amounts applied toward principal and interest in a payment or series of payments.

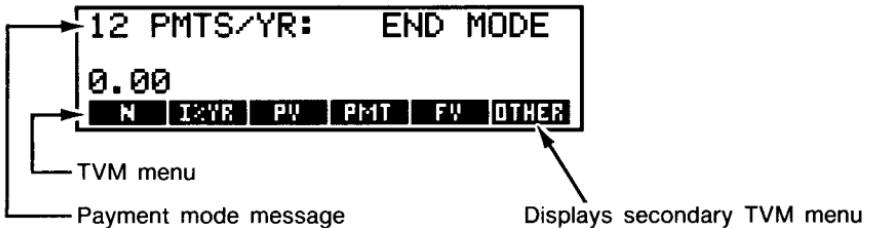
## The TVM Menu

The time value of money (TVM) menu is used for certain compound interest calculations. Specifically, use the TVM menu when there is a series of cash flows (money received or money paid) and:

- The dollar amount is the same for each payment.\*
- The cash flows occur at regular intervals.
- Payments coincide with the compounding periods.

To display the TVM menu, starting from the MAIN menu, press **FIN**, then **TVM**.

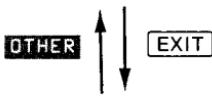
**Figure 4-1. The TVM Menu**



The primary TVM menu has five menu keys for built-in variables, plus **OTHER**. The **OTHER** key displays a secondary menu used to change the payment conditions and to display the amortization (AMRT) menu. The message on the display informs you of the current payment conditions (payment mode).

\* For situations where the amount of the cash flow varies, use the CFLO menu.

**Table 4-1. TVM Menu Keys**

Menu Key	Description
<b>The TVM Menu</b>	
N	Stores or calculates the total number of payments (or compounding periods). N can be expressed in any unit of time—for example, years, months, or days.*
I%YR	Stores or calculates the <i>annual</i> percentage interest rate.
PV	Stores or calculates the present value of the series of future cash flows. To a lender or borrower, PV is the amount of the loan; to an investor, PV is the initial investment.
PMT	Stores or calculates the dollar amount of each periodic payment. The payments are the same amount, and no payments are skipped. Payments can occur at the beginning or end of each period.
FV	Stores or calculates the future value—the dollar amount of the final cash flow, or the compounded value of the series of previous cash flows. FV always occurs at the end of the last period.
	
<b>The Secondary TVM Menu</b>	
#P/Y	Stores the number of payments per year. The value must be an integer in the range 1 through 999.
BEG	Sets <i>Begin mode</i> ; used when payments occur at the beginning of each period.
END	Sets <i>End mode</i> ; used when payments occur at the end of each period.
AMRT	Displays the AMRT (amortization) menu for calculating amortization schedules.

\* When the HP-18C calculates a non-integer N, the answer must be interpreted carefully. The built-in formulas used by the HP-18C do not calculate partial period payments. Interpreting a non-integer N is covered in the savings account example on pages 69 through 71.

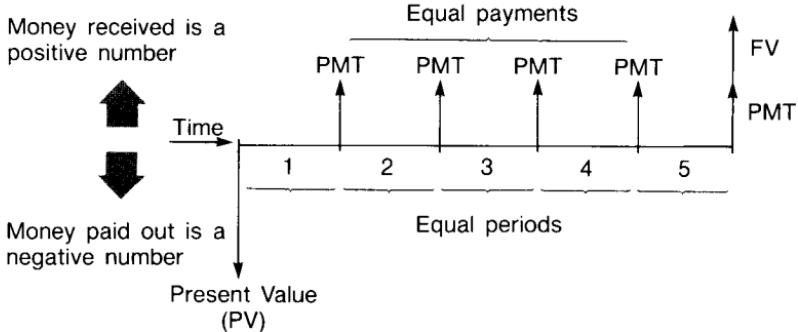
Calculations using a stored non-integer N produces a mathematically correct result, but this result has no simple useful interpretation. The example on pages 145 through 147 use the formula solver to do an "odd-period-at-the-beginning" calculation in which interest begins to accrue prior to the beginning of the first regular payment period.

## Cash Flow Diagrams and Signs of Numbers

It is helpful to illustrate TVM calculations with *cash flow diagrams*. Cash flow diagrams are time lines divided into equal segments of time called *payment periods* or *compounding periods*. Arrows show the cash flows. Money received is a positive number, and the arrow points up. Money paid out is a negative number, and the arrow points down.

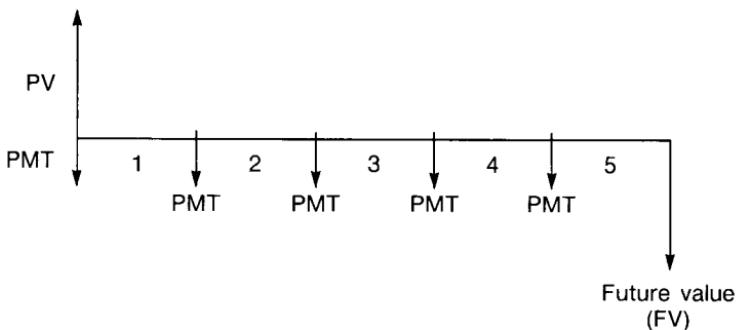
Figure 4-2 shows a typical TVM cash flow diagram.

**Figure 4-2. A Cash Flow Diagram Showing Payments at the End of Each Period**



In figure 4-2, the payments occur at the *end* of each period. Figure 4-3 shows payments occurring at the *beginning* of each period.

**Figure 4-3. A Cash Flow Diagram Showing Payments at the Beginning of Each Period**



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## TVM Calculations

The following general instructions explain how to use the TVM menu.

1. From the MAIN menu, press **FIN**, then **TVM** to display the TVM menu.
2. To clear the TVM variables, press **CLEAR ALL**.
3. Read the message that describes the number of payments per year and the Begin/End mode. If you must change either of these settings, press **OTHER**.
  - To change the number of payments per year, key in the new value and press **N/P/Y**.
  - To change the Begin/End mode, press **BEG** or **END**.
  - Press **EXIT** to return to the primary TVM menu.
4. To store the values you know, key in the number and press the appropriate menu key.
5. To calculate a value, press the appropriate menu key.

Some time value of money calculations require that certain values be set to 0. For example, FV must be set to 0 when you are calculating the periodic payment (PMT) required to fully pay back a loan. There are two ways to set a value to 0:

- Before storing any values, press **[CLEAR ALL]** to clear all the TVM variables.
- Store 0; for example, pressing **0 [FV]** sets FV to 0.

---

## Clearing the TVM Variables

The HP-18C retains the values stored in the TVM built-in variables until they are changed by storing or calculating a new value, or cleared by pressing **[CLEAR ALL]**. Clearing variables sets them equal to 0.

When the HP-18C is displaying the primary TVM menu, pressing **[CLEAR ALL]** clears N, I%YR, PV, PMT, and FV. When the secondary (OTHER) menu is displayed, pressing **[CLEAR ALL]** sets the conditions 12 PMTS/YR: END MODE.

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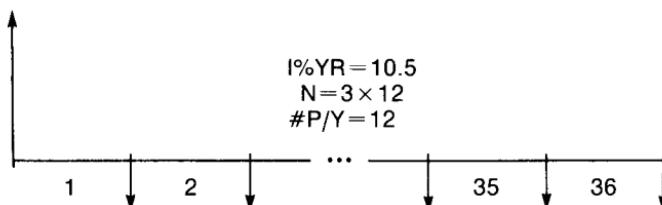
## Loan Calculations

The following three examples illustrate several common loan calculations.

**Example: A car loan. Part 1.** You are financing the purchase of a new car with a 3-year loan at 10.5% annual interest, compounded monthly. The purchase price of the car is \$7,250. Your down payment is \$1,500. What are your monthly payments? (Assume payments start one month after purchase—in other words, at the *end* of the first period.)

**Figure 4-4. A Car Loan**

PV=7,250 - 1,500



**Part 2.** What interest rate would you have to get to reduce your monthly payment by \$10?

Starting from the MAIN menu:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
<b>FIN</b>	<b>TVM</b>	Displays the TVM menu.
<b>CLEAR ALL</b>	<b>0 . 00</b>	Clears the history stack and the TVM variables.
<b>OTHER</b>		Displays the secondary TVM menu.
<b>CLEAR ALL</b>	<b>12 PMTS/YR: END MODE</b>	Sets 12 payments per year; End mode.
<b>EXIT</b>		Displays the TVM menu.

**3**  **12**  **N** **N=36,00**

Stores the number of payments.

**10.5**  **I%YR** **I%YR=10.50**

Stores the annual interest rate.

**7250**  **1500** **PV** **PV=5,750.00**

Stores the amount of the loan.

**PMT** **PMT=-186.89**

Calculates the payment. The negative value means this is money *paid out*.

**Part 2:** To calculate the interest rate that reduces the payment by \$10:

**+ 10**  **PMT** **PMT=-176.89**

Stores the reduced payment amount.

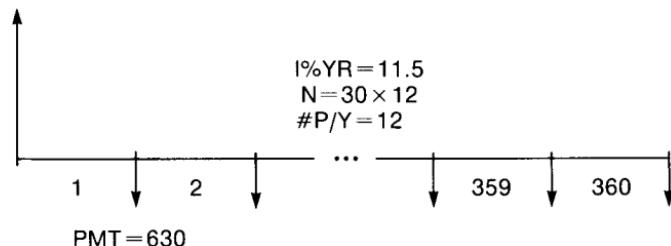
**I%YR** **I%YR=6.75**

Calculates the annual interest rate.

**Example: A home mortgage.** After careful consideration of your personal finances, you've decided that the maximum monthly mortgage payment you can afford is \$630. You can make a \$12,000 down payment, and annual interest rates are currently 11.5%. If you take out a 30-year mortgage, what is the maximum purchase price you can afford?

#### Figure 4-5. A Home Mortgage

PV=?



Starting from the MAIN menu:

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears the history stack and the TVM variables.

These steps are necessary only if you must change the number of periods per year and/or the Begin/End mode.

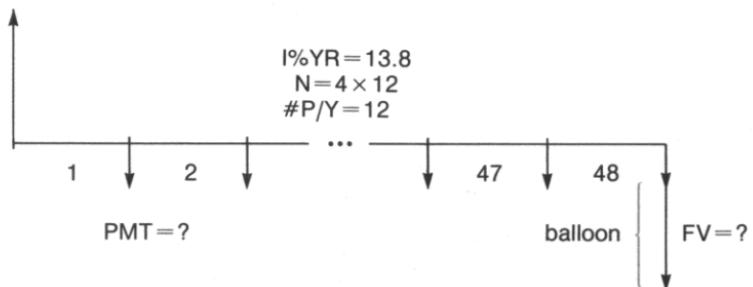
Keys:	Display:	Description:
OTHER		Displays the secondary TVM menu.
CLEAR ALL	12 PMTS/YR: END MODE	Sets 12 payments per year; End mode.

30 <input checked="" type="checkbox"/> 12	N=360.00	Stores the number of payments.
11.5 <input checked="" type="checkbox"/> I%YR	I%YR=11.50	Stores the annual interest rate.
630 <input checked="" type="checkbox"/> PMT	PMT=-630.00	Stores the monthly payment.
<input checked="" type="checkbox"/> PV	PV=63,617.64	Calculates the loan amount.
<input checked="" type="checkbox"/> 12000 =	75,617.64	Calculates the total price of the house (loan plus down payment).

**Example: A mortgage with a balloon payment.** You've taken out a 25-year, \$75,250 mortgage at 13.8% annual interest. You anticipate that you will own the house for four years and then sell it, repaying the loan in a "balloon payment." What will be the size of your balloon payment at the end of four years?

**Figure 4-6. A Home Mortgage With a Balloon Payment After Four Years**

$$PV = 75,250$$



The problem is done in two steps:

1. Calculate the monthly payment.
2. Calculate the balloon payment after 4 years.

Starting from the MAIN menu:

Keys:	Display:	Description:
<b>FIN</b> <b>TVM</b>		Displays the TVM menu.
<b>CLEAR ALL</b>	0.00	Clears the history stack and the TVM variables.

These steps are necessary only if you must change the number of periods per year and/or the Begin/End mode.

OTHER

Displays the secondary menu.

CLEAR ALL

12 PMTS/YR: END  
MODE

Sets 12 payments per year, End mode.

EXIT

Displays the TVM menu.

**Step 1.** Calculate PMT for the mortgage.

25  12

N

N=300.00

Calculates the number of payments in 25 years and stores the value in N.

13.8  I%YR

I%YR=13.80

Stores the annual interest rate.

75250  PV

PV=75,250.00

Stores the amount of the loan.

PMT

PMT=-894.33

Calculates the monthly payment.

**Step 2.** Calculate the balloon payment after 4 years:

894.33  +/-

PMT

PMT=-894.33

Stores the rounded value of PMT.\*

4  12  N

N=48.00

Calculates the number of payments in 4 years and stores the value in N.

FV

FV=-73,408.81

Calculates the balloon payment after four years. This amount plus the last monthly payment repays the loan.

\* The PMT stored in the previous step is the 12-digit number -894.330557971. The calculation of the balloon payment must use the actual monthly payment amount—in this example, the rounded number.

## Amortization

The **AMRT** menu is used to calculate these values for a single loan payment or a series of loan payments:

- The balance of the loan after the payment(s) are made.
- The amount of the payment(s) applied toward interest.
- The amount of the payment(s) applied toward principal.

To display the AMRT menu, starting from the primary TVM menu:

1. Press **OTHER**.
2. Press **AMRT**.

**Figure 4-7. The AMRT (Amortization) Menu**

KEY IN #PAYMENTS TO  
AMORTIZE; PRESS (#P)  
-73,408.81  
**#P INT PRIN BAL NEXT TABLE**

Table 4-2 describes the AMRT menu keys.

**Table 4-2. AMRT menu keys.**

Menu Key	Description
<b>#P</b>	Stores the number of payments to be amortized, and calculates the amortization schedule. The value entered must be an integer in the range 1 through 1,200.
<b>INT</b>	Displays the amount of the payments applied toward interest.
<b>PRIN</b>	Displays the amount of the payments applied toward principal.
<b>BAL</b>	Displays the balance of the loan.
<b>NEXT</b>	Calculates the amortization schedule for the next set of payments, using the stored value of #P.
<b>TABLE</b>	Prints an amortization table. (Refer to page 156 for additional information.)

To calculate an amortization schedule, starting from the MAIN menu:

1. Press **FIN**, then **TVM** to display the primary TVM menu.
2. Press **CLEAR ALL** to clear N, I%YR, PV, PMT, and FV to 0.
3. Key in the annual interest rate and press **I%YR**.
4. Key in the amount of the loan (the principal) and press **PV**.
5. Key in the amount of the periodic payment\* (using **+/**- to change the sign) and press **PMT**.
6. Press **OTHER** to display the rest of the TVM menu.
7. If necessary, change the number of payments per year by keying in the value and pressing **#P/Y**.
8. If necessary, change the Begin/End mode by pressing **BEG** or **END**.
9. Press **AMRT**.
10. Key in the number of payments to be amortized and press **#P**. The HP-18C displays the payments amortized, the balance of the loan, and the amount applied toward interest.
11. To display the amount applied toward the principal, press **PRIN**.
12. You can use the **INT** or **BAL** keys to redisplay those values on the calculator line.
13. To continue calculating the schedule for subsequent payments, do **a** or **b**:
  - a. Key in the number of succeeding payments to be amortized and press **#P**.
  - b. Press **NEXT** to use the previously stored value for #P.

\* If you must calculate the periodic payment, substitute these instructions for steps 5 through 8, above:

1. Key in the total number of payments and press **N**.
2. Press **OTHER** to display the secondary TVM menu.
3. If you must change the number of payments per year, key in the value and press **#P/Y**.
4. If necessary, change the Begin/End mode by pressing **BEGIN** or **END**.
5. Press **EXIT** to display the primary TVM menu.
6. Press **PMT** to calculate the payment.
7. Press **OTHER**.

To start the amortization schedule over from payment #1, press **[CLEAR ALL]** and proceed starting at step #10.

Amortization calculations use values of PV, PMT, and INT rounded to the number of decimal places specified by the current display setting. (All 12 digits of I%YR are used.) However, the stored values of PV and PMT do not change.

**Example: Amortization schedule for a home mortgage. Part 1.**

To purchase your new home, you have taken out a 30-year, \$65,000 mortgage at 12.5% annual interest. Your monthly payment is \$693.72. Calculate the amount of the first year's and second year's payments that are applied toward principal and interest.

**Part 2.** Calculate the loan balance after 3½ years.

Starting from the MAIN menu:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
<b>FIN</b> <b>TVM</b>		Displays the TVM menu.
<b>[CLEAR ALL]</b>	<b>0.00</b>	Clears the history stack and the TVM variables.
<b>12.5</b> <b>I/YR</b>	<b>I/YR=12.50</b>	Stores the annual interest rate.
<b>65000</b> <b>PV</b>	<b>PV=65,000.00</b>	Stores the amount of the loan.
<b>693.72</b> <b>+/-</b>		Stores the monthly payment.
<b>PMT</b>	<b>PMT=-693.72</b>	
<b>OTHER</b>		Displays the secondary TVM menu.
<b>[CLEAR ALL]</b>	<b>12 PMTS/YR: END MODE</b>	Sets 12 payments per year, End mode.
<b>AMRT</b>		Displays the AMRT menu.

12	#P	PAYMENTS: 1-12 BALANCE=64,788.52 INTEREST=-8,113.16	Calculates the amortization schedule for the first 12 payments.
	PRIN	PRINCIPAL=-211.48	Displays the amount applied toward the principal for payments 1 through 12.
	NEXT	PAYMENTS: 13-24 BALANCE=64,549.03 INTEREST=-8,085.15	Calculates the amortization schedule for the next 12 payments.
	PRIN	PRINCIPAL=-239.49	Displays the amount applied toward the principal for payments 13 through 24.

**Part 2:** To calculate the balance after  $3\frac{1}{2}$  years (42 payments), amortize 18 additional payments ( $42 - 24 = 18$ ):

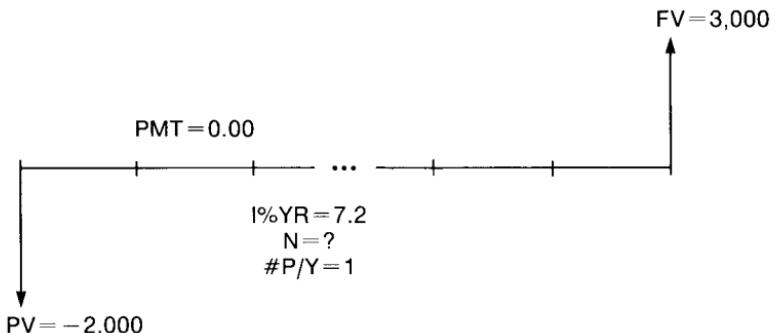
18	#P	PAYMENTS: 25-42 BALANCE=64,129.05 INTEREST= -12,066.98	Calculates the amortization schedule for the next 18 months.
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## Savings Calculations

The following examples illustrate two common savings calculations.

**Example: A savings account.** You deposit \$2,000 into a savings account that pays 7.2% annual interest, compounded annually. If you make no other deposits into the account, how long will it take for the account to contain \$3,000?

**Figure 4-8. A Savings Account**



Starting from the MAIN menu:

<b>Keys:</b>	<b>Display:</b>	<b>Description</b>
<b>[ FIN ] [ TVM ]</b>		Displays the TVM menu.
<b>[ ] [ CLEAR ALL ]</b>	<b>0 . 00</b>	Clears the history stack and TVM variables.
<b>[ OTHER ]</b>		Displays the secondary TVM menu.
<b>1 [ #P/Y ] [ END ]</b>	<b>1 PMTS/YR: END</b>	Sets 1 payment (period) per year, End mode.
<b>[ EXIT ]</b>		Displays the TVM menu.
<b>7.2 [ I%YR ]</b>	<b>I%YR=7.20</b>	Stores the annual interest rate.
<b>2000 [+/-]</b>		Stores the amount of the deposit.
<b>[ PV ]</b>	<b>PV=-2,000.00</b>	
<b>3000 [ FV ]</b>	<b>FV=3,000.00</b>	Stores 3,000 in FV.
<b>[ N ]</b>	<b>N= 5.83</b>	Calculates the number of years.

Since the calculated value of N is between 5 and 6, it will take 6 years of annual compounding to achieve a balance of at least \$3,000. The actual balance at the end of six years can be calculated:

6 [N]

N=6.00

Stores 6 in N.

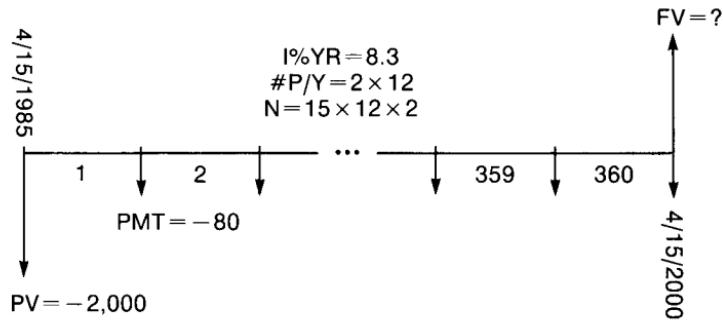
[FV]

FV=3,035.28

Calculates the balance after six years.

**Example: An Individual Retirement Account (IRA).** You opened an IRA on April 15, 1985, with a deposit of \$2,000. Thereafter, you deposit \$80.00 into the account semimonthly. The account pays 8.3% annual interest, compounded semimonthly. How much money will the account contain on April 15, 2000?

**Figure 4-9. An IRA**



Starting from the MAIN menu:

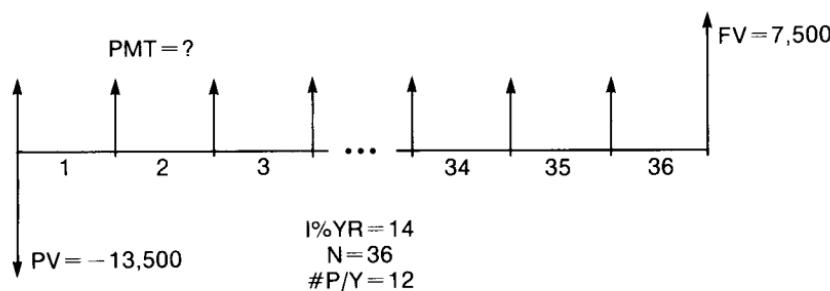
<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
<b>FIN</b> <b>TVM</b>		Displays the TVM menu.
<b>CLEAR ALL</b>	0.00	Clears the history stack and the TVM variables.
<b>OTHER</b>		Displays the secondary TVM menu.
<b>2</b> <b>x</b> <b>12</b> <b>P/Y</b> <b>END</b>	24 PMTS/YR: END MODE	Sets 24 payments per year, End mode.
<b>EXIT</b>		Displays the TVM menu.
<b>15</b> <b>x</b> <b>12</b> <b>x</b> <b>2</b> <b>N</b>	N=360.00	Calculates the number of deposits and stores the value in N.
<b>8.3</b> <b>I%YR</b>	I%YR=8.30	Stores the annual interest rate.
<b>2000</b> <b>+/</b> <b>PV</b>	PV=-2,000.00	Stores the initial deposit.
<b>80</b> <b>+/</b> <b>PMT</b>	PMT=-80.00	Stores the semimonthly payment.
<b>FV</b>	FV=63,963.84	Calculates the balance in the IRA after 15 years.

## Leasing Calculations

Two common leasing calculations are calculating the lease payment necessary to achieve a specified yield, and finding the present value (capitalized value) of a lease.

**Example: Calculating a lease payment.** A new car valued at \$13,500 is to be leased for 3 years, with an option to purchase the car for \$7,500 at the end of the leasing period. What monthly payments, payable at the beginning of each month, are necessary to yield the lessor 14% annually?

**Figure 4-10. A Car Lease**



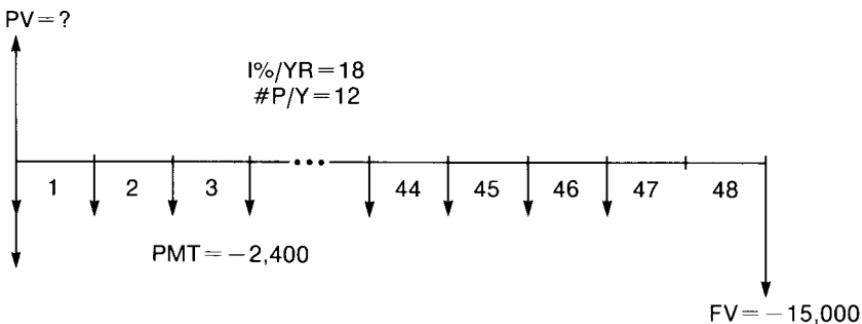
Notice that the first lease payment occurs at the *beginning* of the first period. Starting from the **MAIN** menu:

Keys:	Display:	Description:
<b>FIN</b> <b>TVM</b>		Displays the TVM menu.
<b>CLEAR ALL</b>	0 . 00	Clears the history stack and the TVM variables.
<b>OTHER</b>		Displays the secondary TVM menu.

<b>12 #P/Y</b>		Sets 12 payments per year, Begin mode.
<b>BEGIN</b>	<b>12 PMTS/YR: BEGIN MODE</b>	
<b>EXIT</b>		Displays the TVM menu.
<b>36 N</b>	<b>N=36.00</b>	Stores the number of payments.
<b>14 I%YR</b>	<b>I%YR=14.00</b>	Stores the annual interest rate.
<b>13500 +/-</b>	<b>PV=-13,500.00</b>	Stores the present value of the car in PV.
<b>- PV</b>		
<b>7500 FV</b>	<b>FV=7,500.00</b>	Stores the purchase option value in FV.
<b>PMT</b>	<b>PMT=289.19</b>	Calculates the monthly lease payment.

**Example: Present value of a lease with advanced payments and option to buy.** Ratajak Dairy, Inc. is leasing a machine for 4 years. Monthly payments are \$2,400; an additional \$2,400 payment at the beginning of the leasing period replaces the final payment. The leasing agreement includes an option to buy the machine for \$15,000 at the end of the leasing period. What is the capitalized value of the lease, assuming that the interest rate Ratajak pays to borrow funds is 18%, compounded monthly?

**Figure 4-11. Present Value of a Lease With an Additional Advanced Payment and an Option to Buy at the End of the Leasing Period**



The problem is done in four steps:

1. Calculate the present value of the 47 monthly payments.
2. Add to this value the additional advance payment.
3. Find the present value of the buy option.
4. Sum the values calculated in steps 2 and 3.

Starting from the MAIN menu:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
<b>FIN</b> <b>TVM</b>		Displays the TVM menu.
<b>CLEAR ALL</b>	<b>0.00</b>	Clears the history stack and the TVM variables.
<b>OTHER</b>	<b>0.00</b>	Displays the secondary TVM menu.
<b>12 #P/Y</b> <b>BEGIN</b>	<b>12 PMTS/YR: BEGIN MODE</b>	Sets 12 payments per year, Begin mode.
<b>EXIT</b>		Displays the TVM menu.

**Step 1:** Find the present value of the monthly payments:

47	N	N=47.00	Stores the number of payments.
18	I%YR	I%YR=18.00	Stores the annual interest rate.
2400	+/-	PMT=-2,400.00	Stores the monthly payment.
	PMT	PV=81,735.58	Calculates the present (capitalized) value of the 47 monthly payments.
	PV		

**Step 2:** Add the additional advance payment to PV. Store the answer.

[+]	2400	=	84,135.58	Calculates the present value of all the payments.
	STO	0		Stores 84,135.58 in register 0.

**Step 3:** Find the present value of the buy option.

48	N	N=48.00	Stores the number of periods.
15000	+/-	FV=-15,000.00	Stores the buy option.
0	PMT	PMT=0.00	Clears PMT.
	PV	PV=7,340.43	Calculates the present value of the buy option.

**Step 4:** Add the results of step 3 and 4.

[+]	RCL	0	=	91,476.00	Calculates the present (capitalized) value of the lease.
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## Interest Rate Conversions

The ICONV (interest conversion) menu converts between nominal and effective interest rates, using either of two compounding methods:

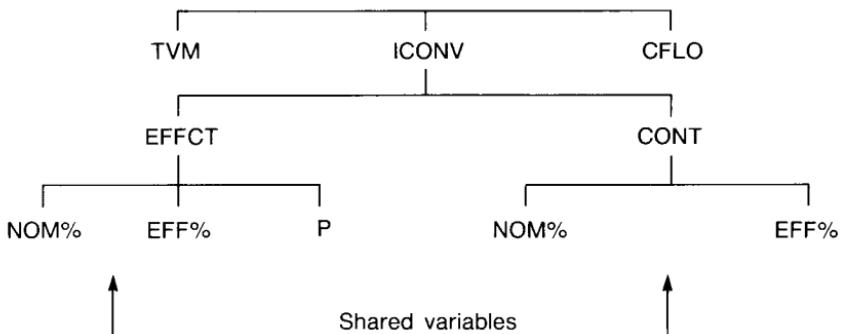
- Periodic compounding; for example, quarterly, monthly, or daily compounding.
- Continuous compounding.

To convert between nominal and effective interest rates, starting from the MAIN menu:

1. Press **FIN**, then **ICONV** to display the ICONV menu.
2. Press the menu key for the desired compounding method (do **a** or **b**):
  - a. Press **EFFCT** for periodic compounding.
  - b. Press **CONT** for continuous compounding.
3. Key in the nominal (or effective) interest rate and press **NOM%** (or **EFF%**).
4. For periodic compounding only: Key in the number of periods per year and press **P**.
5. Press **EFF%** (or **NOM%**) to calculate the effective (or nominal) interest rate.

Values of EFF% and NOM% are shared between the EFFCT and CONT menus. For example, if you calculate an effective interest rate in CONT, that value remains stored in EFF% if you exit the CONT menu and enter the EFFCT menu.

**Figure 4-12. Shared Variables**



---

## **Clearing the ICONV Variables**

NOM%, EFF%, and P are cleared when you enter the ICONV menu.

Pressing **[CLEAR ALL]** in the EFFCT or CONT menus clears NOM% and EFF%. In the EFFCT menu, P is also cleared.

**Example: Converting from a nominal to an effective interest rate.** You are considering opening a savings account in one of three banks. Which bank has the most favorable interest rate?

- Bank #1 6.7% annual interest, compounded quarterly
- Bank #2 6.65% annual interest, compounded monthly
- Bank #3 6.65% annual interest, compounded continuously

Starting from the MAIN menu:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
<b>[ FIN ] [ICONV ]</b>		Displays the ICONV menu.
<b>[EFFC ]</b>		Displays the EFFCT menu.
<b>[CLEAR ALL]</b>	<b>0 . 00</b>	Clears the history stack and EFFCT variables.
<b>6.7 [ NOM% ]</b>	<b>NOM% = 6 . 70</b>	Stores the nominal annual interest rate for bank #1.
<b>4 [ P ]</b>	<b>P = 4 . 00</b>	Stores the number of compounding periods per year.
<b>[EFF% ]</b>	<b>EFF% = 6 . 87</b>	Calculates the effective interest rate for bank #1.
<b>6.65 [ NOM% ]</b>	<b>NOM% = 6 . 65</b>	Stores the nominal annual interest rate for bank #2.
<b>12 [ P ]</b>	<b>P = 12 . 00</b>	Stores the number of compounding periods per year.
<b>[EFF% ]</b>	<b>EFF% = 6 . 86</b>	Calculates the effective interest rate for bank #2.
<b>[EXIT] [CONT ]</b>		Displays the CONT menu. The previous values of NOM% and EFF% are retained.
<b>[EFF% ]</b>	<b>EFF% = 6 . 88</b>	Calculates the effective rate for bank #3.

The calculations show that bank #3 is offering the most favorable interest rate.

# Cash Flow Calculations

## Introduction

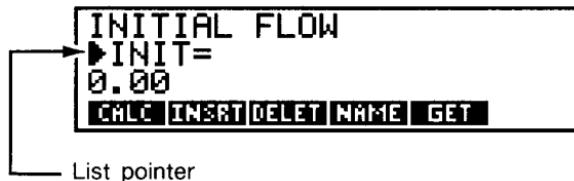
The cash flow (CFLO) menu is used to analyze cash flows (money received or money paid out) of uneven amounts that occur at regular intervals.\* Once you've entered the cash flows, you can calculate:

- The total of the cash flows.
- The internal rate of return (IRR%).
- The net present value (NPV), net uniform series (NUS), and net future value (NFV) for a specified periodic interest rate (I%).

## The CFLO Menu

To display the cash flow (CFLO) menu, starting from the MAIN menu, press **FIN**, then **CFLO**. If you haven't previously used the CFLO menu, the HP-18C displays an empty cash flow number list.

**Figure 5-1. An Empty CFLO Number List**



\* You can use the cash flow menu for cash flows of equal amounts at regular intervals. However, these situations are handled more easily in the TVM menu.

The menu labels show the operations you can perform on the number list. Table 5-1 briefly describes these operations.

**Table 5-1. CFLO Menu Keys**

Menu Key	Description
<b>CALC</b>	Displays the CALC menu for calculating the total, IRR%, NPV, NUS, and NFV.
<b>INSRT*</b>	Used to insert cash flows into the list.
<b>DELET*</b>	Used to delete cash flows from the list.
<b>NAME*</b>	Used to name the list.
<b>GET*</b>	Used to switch from one list to another or to create a new list.

\* Covered in chapter 7.

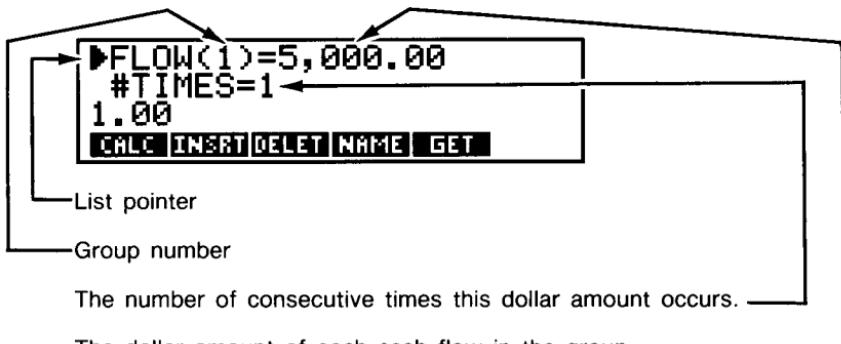
If you have previously used the CFLO menu, your display will look different. Instead of displaying an empty list, the HP-18C displays the beginning of the CFLO number list you worked with most recently. You can press to see more of the list.

To display an empty list, you can:

- Clear the list by pressing **CLEAR ALL**. Clearing number lists is covered in more detail on page 114.
- Create a new list by pressing **GET**, then **\*NEW**. Creating new number lists is covered in more detail on pages 112 and 113.

The maximum number of cash flows you can store depends on the amount of unused calculator memory. When calculator memory is otherwise empty, you can store approximately 100 cash flows (simple or grouped).

**Figure 5-2. A CFLO Number List With Numbers Already In It**



## Using Number Lists

You can think of a number list both as a collection of numbers, and as a location in calculator memory where the numbers are stored.\*

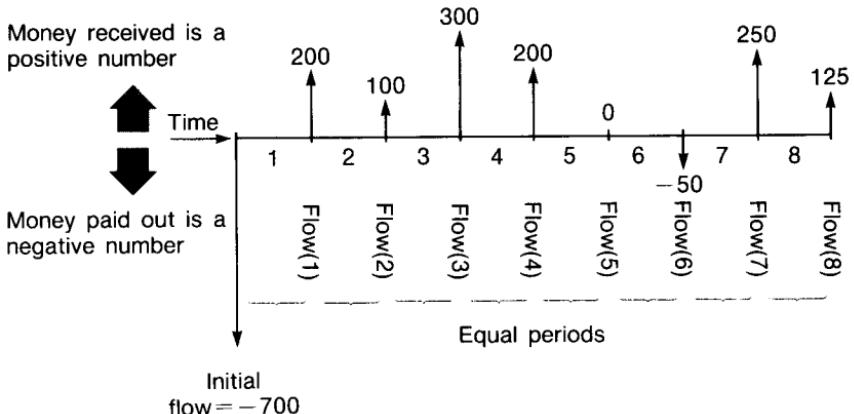
The HP-18C has a variety of features to help you use number lists effectively. Some of these features are covered in this chapter and demonstrated in the examples. The rest of the features are explained in chapter 7.

## Cash Flow Diagrams and Signs of Numbers

The sign conventions used for cash flow calculations are the same as those used in time value of money calculations. Figure 5-3 illustrates a typical series of cash flows. Situations of this type, where there are no consecutive, equal cash flows, are called *simple cash flows*.

\* The HP-18C can store two types of number lists—SUM and CFLO.

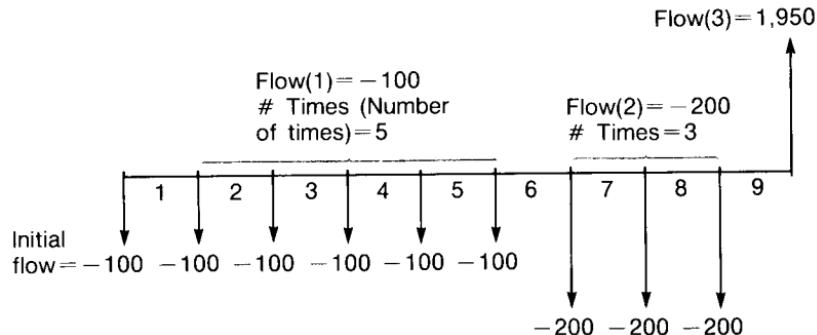
**Figure 5-3. Simple Cash Flows**



The horizontal line represents time. The line is divided into equal compounding periods. The vertical lines represent the cash flows. For money received, the line points up; for money paid out, the line points down. In this case, the investor has invested \$700, and this investment has generated a series of cash flows, starting at the end of the first period. Notice that there is no cash flow (a cash flow of 0) for period five, and that the investor *pays* a small amount in period six.

Figure 5-4 illustrates a cash flow diagram in which two series of consecutive, equal cash flows occur. Consecutive, equal cash flows are called *grouped cash flows*.

**Figure 5-4. Grouped Cash Flows**



After an initial payment of \$100, the investor pays \$100 at the end of periods 1 through 5, and \$200 at the end of periods 6 through 8. The investment returns \$1,950 at the end of period 9.

## Entering Cash Flows

The list pointer (►) shows you where the next number you enter is placed. When the list is empty, the pointer points to the initial flow.

To enter cash flows into the CFLO number list:

1. Make sure your cash flows are occurring at regular intervals and at the *end* of each period (see figure 5-3). If one or more periods are skipped, set their cash flows equal to 0. If consecutive, equal cash flows occur, you can group them to make entering the data easier (see figure 5-4).
2. Key in the value of the initial cash flow (remember the sign conventions—use [+/-], if necessary, to change the sign) and press **[INPUT]**.
3. The pointer now points to FLOW(1). Key in the value for FLOW(1) and press **[INPUT]**.
4. The pointer now points to #TIMES—the number of consecutive occurrences of FLOW(1). #TIMES has been automatically set to 1, and 1.00 is displayed on the calculator line as a typing aid. Do **a** or **b**:
  - a. To retain the value 1, press **[INPUT]**.\*
  - b. To change #TIMES, key in the number and press **[INPUT]**.†

**Figure 5-5. Entering #TIMES**



\* Pressing **[↓]** to move the list pointer to the next cash flow also retains the value 1.

† The maximum value for #TIMES is 999.

- 
5. Continue entering values. The HP-18C recognizes the end of the list when a flow is left blank (no value is entered).

---

## Viewing and Editing the List

The  $\uparrow$  and  $\downarrow$  keys move the list pointer up and down the list one number at a time.  $\blacksquare \uparrow$  and  $\blacksquare \downarrow$  move the pointer to the beginning and end of the list.

To change an incorrect number after it's been entered into the number list:

1. Position the pointer at the incorrect value.
2. Key in the correct value and press **[INPUT]**.

To add a cash flow to the bottom of the list, move the pointer to the bottom of the list (press  $\blacksquare \downarrow$ ) and enter the value and #TIMES.

If you leave out a cash flow, you can insert it at its proper place. You can also delete a cash flow. Inserting and deleting numbers is covered in chapter 7.

---

## Cash Flow Calculations

Press **[CALC]** to display the CALC menu. Table 5-2 describes the calculations you can do.

- To calculate the sum of the cash flows, press **[TOTAL]**.
- To calculate the internal rate of return, press **[IRR%]**.\* The HP-18C calculates the *periodic* rate of return. To calculate the annual return, multiply the periodic rate by the number of periods per year.

---

\* The calculations for internal rate of return are complex and may take a relatively long time. To halt the calculation, press any key. In certain cases, the HP-18C displays a message indicating that the calculation cannot continue without further information from you, or that there is no solution. Refer to Appendix B for additional information about calculating IRR%.

- To calculate net present value (**NPV**), net uniform series (**NUS**), and/or net future value (**NFV**):

- Key in the periodic interest rate, expressed as a percentage, and press **I%**.
- Press the menu key(s) for the calculation(s) you want to do.

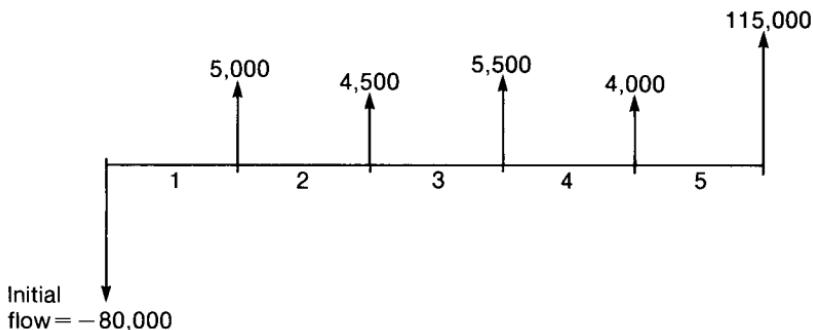
**Table 5-2. The CALC Menu for CFLO Lists**

Menu Key	Description
<b>TOTAL</b>	Calculates the sum of the cash flows.
<b>IRR%</b>	Calculates the <i>internal rate of return</i> —the interest (discount) rate at which the net present value of the cash flows equals 0. For conventional investments*, the investment is attractive if IRR% is greater than the cost of capital.
<b>I%</b>	Stores the <i>periodic interest rate</i> , expressed as a percentage (sometimes called <i>cost of capital</i> , <i>discount rate</i> , or <i>required rate of return</i> ).
<b>NPV</b>	Calculates the <i>net present value</i> —the present value of a series of cash flows plus the initial cost of the investment, computed for a specified periodic interest rate.
<b>NUS</b>	Calculates the <i>net uniform series</i> —the dollar amount of regular, equal cash flows having a present value equivalent to the net present value.
<b>NFV</b>	Calculates the <i>net future value</i> of a series of cash flows, calculated by finding the future value of the net present value.

\* Conventional investments meet four criteria—(1) the initial cash flow is negative, (2) some flows following the initial flow are positive, (3) the sequence of cash flows changes sign only once, and (4) the sum (TOTAL) of the cash flows is positive.

**Example: Calculating IRR% and NPV of an investment. Part 1.**  
An investor makes an initial investment of \$80,000, and expects returns over the next five years as illustrated in figure 5-6.

**Figure 5-6. Cash Flows for an Investment**



Calculate the total of the cash flows and the internal rate of return of the investment. In addition, calculate the net present value and net future value, assuming an annual interest rate of 10.5%.

**Part 2.** Assuming the same interest rate, calculate NPV if cash flow #4 is reduced from \$4,000 to \$1,000.

Starting from the MAIN menu:

Keys:	Display:	Description:
<b>FIN</b> <b>CFLO</b> *		Displays the cash flow menu.
<b>[CLEAR ALL]</b>		Clears the list.
<b>YES</b>	INITIAL FLOW ►INIT=	
80000 [+/] [INPUT]	INIT=-80,000.00	Enters the initial cash flow.
	►FLOW(1)= #TIMES=	

\* If you want to preserve the current number list, skip the next step (pressing **[CLEAR ALL]**). Instead, name the list (refer to page 111), and then press **GET** **\*NEW**.

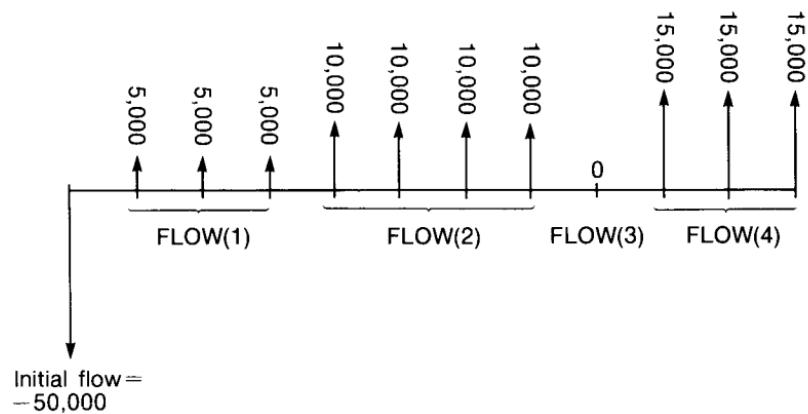
5000	<b>[INPUT]</b>	FLOW(1)=5,000.00 ►#TIMES=1	Enters FLOW(1).
	<b>[INPUT]</b>	►FLOW(2)= #TIMES=	Enters 1 as the #TIMES for FLOW(1).
4500	<b>[INPUT]</b>	FLOW(2)=4,500.00 ►#TIMES=1	Enters FLOW(2).
	<b>[INPUT]</b>	►FLOW(3)= #TIMES=	Enters #TIMES for FLOW(2).
5500	<b>[INPUT]</b>	FLOW(3)=5,500.00 ►#TIMES=1	Enters FLOW(3).
	<b>[INPUT]</b>	►FLOW(4)= #TIMES=	
4000	<b>[INPUT]</b>	FLOW(4)=4,000.00 ►#TIMES=1	Enters FLOW(4).
		►FLOW(5)= #TIMES=	
115000		FLOW(5)= 115,000.00 ►#TIMES=1	Enters FLOW(5).
	<b>[INPUT]</b> <b>[INPUT]</b>	►FLOW(6)= #TIMES=	
	<b>CALC</b>		Displays the CALC menu.
	<b>TOTAL</b>	TOTAL=54,000.00	Calculates the sum of the cash flows.
	<b>IRR%</b>	IRR% = 11.93	Calculates the internal rate of return.
10.5	<b>I%</b>	I% = 10.50	Stores the periodic interest rate.
	<b>NPV</b>	NPV = 4,774.63	Calculates the NPV.
	<b>NFV</b>	NFV = 7,865.95	Calculates the NFV.

**Part 2.** Calculate NPV at an interest rate of 10.5% if cash flow #4 is reduced to \$1,000.

<b>EXIT</b>	<b>►FLOW(6)=</b> <b>#TIMES=</b>	Displays the number list.
<b>↑</b> <b>↑</b> <b>↑</b> <b>↑</b>	<b>►FLOW(4)=4,000.00</b> <b>#TIMES=1</b>	Moves the number list pointer to cash flow #4.
1000 <b>INPUT</b>	<b>►FLOW(4)=1,000.00</b> <b>►#TIMES=1</b>	Changes cash flow #4 to \$1,000.
<b>CALC</b>		Displays the CALC menu.
<b>NPV</b>	<b>NPV=2,762.43</b>	Calculates NPV for the edited list.

**Example: An investment with grouped cash flows.** You are considering an investment that requires a cash outlay of \$50,000, with the promise of annual cash flows as shown in figure 5-7:

**Figure 5-7. An Investment With Grouped Cash Flows**



Calculate IRR%. Also, find NPV at an annual interest rate of 9%.

First, organize the data:

Group Number	Amount	Number of Times
Initial	-50,000	—
1	5,000	3
2	10,000	4
3	0	1
4	15,000	3

Starting from the MAIN menu:

Keys:	Display:	Description:
<b>FIN</b> <b>CFLO</b> *		Displays the CFLO menu.
<b>[CLEAR ALL]</b>		Clears the number list.
<b>YES</b>	<b>INITIAL FLOW</b>	
	<b>►INIT=</b>	
50000 <b>[+/-]</b> <b>[INPUT]</b>	<b>INIT=-50,000.00</b>	Enters the initial cash flow.
	<b>►FLOW(1)=</b>	
	<b>#TIMES=</b>	
5000 <b>[INPUT]</b> 3 <b>[INPUT]</b>	<b>FLOW(1)=5,000.00</b>	Enters FLOW(1).
	<b>►#TIMES=3</b>	
	<b>►FLOW(2)=</b>	
	<b>#TIMES=</b>	
10000 <b>[INPUT]</b> 4 <b>[INPUT]</b>	<b>FLOW(2)=10,000.00</b>	Enters FLOW(2).
	<b>►#TIMES=4</b>	
	<b>►FLOW(3)=</b>	
	<b>#TIMES=</b>	

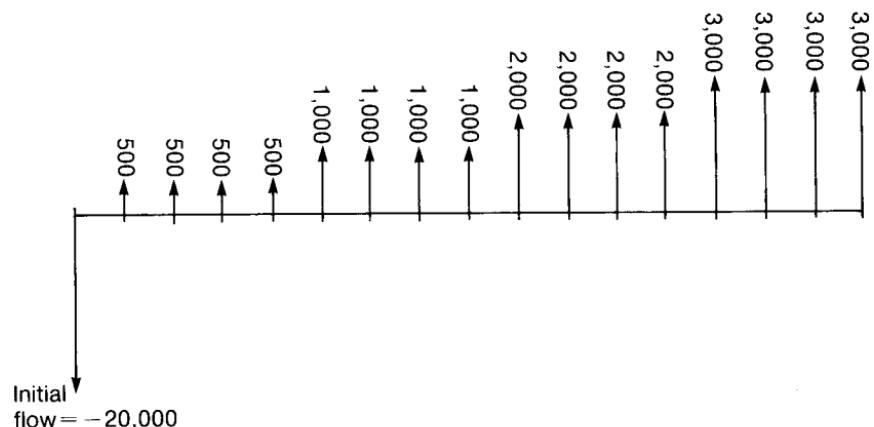
\* If you want to preserve the current number list, skip the next step (pressing **[CLEAR ALL]**). Instead, name the list (refer to page 111), and then press **[GET]** **\*NEW**.

0 [INPUT]	►FLOW(3)=	Enters FLOW(3)
[INPUT]	#TIMES=	
15000 [INPUT] 3	►FLOW(4)=15,000	Enters FLOW(4).
[INPUT]	►#TIMES=3	
	►FLOW(5)=	
	#TIMES=	
[CALC]		Displays the CALC menu.
[IRR%]	IRR% = 11.30	Calculates IRR%.
9 [I%]	I% = 9.00	Stores the periodic (annual) interest rate.
[NPV]	NPV = 6,728.63	Calculates NPV.

**Example: An investment with quarterly returns.** You have been offered an opportunity to invest \$20,000. The investment returns quarterly payments over four years as follows:

- Year 1 4 payments of \$500
- Year 2 4 payments of \$1,000
- Year 3 4 payments of \$2,000
- Year 4 4 payments of \$3,000

**Figure 5-8. An Investment With Quarterly Returns**



Calculate the annual rate of return for this investment.

Starting from the MAIN menu:

Keys:	Display:	Description:
<b>FIN</b> <b>CFL0</b> *		Displays the CFLO menu.
<b>[CLEAR ALL]</b>		Clears the number list.
<b>YES</b>	INITIAL FLOW ►INIT=	
20000 <b>+/-</b> <b>INPUT</b>	INIT=-20,000.00	Enters the initial cash flow.
	►FLOW(1)= #TIMES=	
500 <b>INPUT</b>	FLOW(1)=500.00	Enters FLOW(1).
4 <b>INPUT</b>	►#TIMES=4	
	►FLOW(2)= #TIMES=	
1000 <b>INPUT</b>		Enters FLOW(2),
4 <b>INPUT</b>		FLOW(3) and FLOW(4).
2000 <b>INPUT</b>		
4 <b>INPUT</b>		
3000 <b>INPUT</b>		
4 <b>INPUT</b>	►FLOW(5)= #TIMES=	
<b>CALC</b> <b>IRR%</b>	IRR%=2.43	Calculates the periodic rate of return.
<b>x</b> 4 <b>=</b>	9.72	Calculates the nominal annual rate of return.

\* If you want to preserve the current number list, skip the next step (pressing **[CLEAR ALL]**). Instead, name the list (refer to page 111), and then press **GET** **\*NEW**.

# Running Total and Statistics Calculations

## Introduction

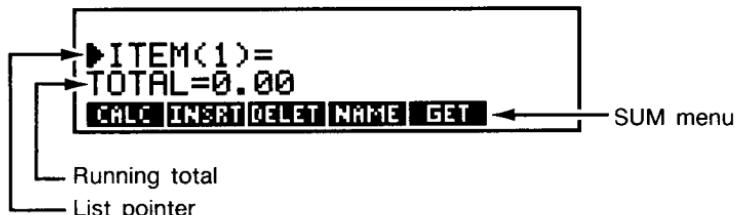
The SUM menu is used to calculate the running total of a list of numbers and to do statistical calculations. As you enter the numbers, the HP-18C displays the running total. Once the list of numbers has been entered, you can:

- Calculate the mean, median, standard deviation, and/or range (largest number minus the smallest number).
- Display the largest (maximum) and smallest (minimum) number in the list.
- Sort the list from smallest number to largest number.
- Do curve-fitting and forecasting calculations using two SUM lists and one of four models—linear, exponential, logarithmic, and power. (Curve fitting for the linear model is called *linear regression*.)

## The SUM Menu

To display the SUM menu, press **SUM** in the MAIN menu. If you haven't previously used the SUM menu, the HP-18C displays an empty SUM number list.

**Figure 6-1. An Empty SUM Number List**



The menu labels show the operations you can perform on your SUM number list. Table 6-1 briefly describes these operations.

**Table 6-1. SUM Menu Keys**

Menu Key	Description
CALC	Displays the CALC menu, which is used to do statistical calculations.
INSRT*	Used to insert numbers into the list.
DELET*	Used to delete numbers from the list.
NAME*	Used to name the list.
GET*	Used to switch from one list to another or to create a new list.

\* Covered in chapter 7.

If you have previously used the SUM menu, your display will look different. Instead of displaying an empty list, the HP-18C displays the SUM list you worked with most recently. You can press  $\downarrow$  to see more of the list.

To display an empty list, you can:

- Clear the list by pressing  $\boxed{\text{CLEAR ALL}}$ . Clearing number lists is covered in more detail on page 114.
- Create a new list by pressing  $\boxed{\text{GET}}$ , then  $\boxed{* \text{NEW}}$ . Creating new number lists is covered in more detail on pages 112 and 113.

**Figure 6-2. A SUM Number List With Numbers Already In It**



## Using Number Lists

You can think of a number list both as a collection of numbers and as a location in calculator memory where the numbers are stored.\*

The HP-18C has a variety of features to help you use number lists effectively. Some of these features are covered in this chapter and demonstrated in the examples. The rest of the features are covered in chapter 7.

## Entering Numbers and Viewing the Running Total

The list pointer (▶) shows you where the next number you enter is placed. When the list is empty, the pointer points to ITEM(1) and the TOTAL=0.00.

To enter numbers into the empty list:

1. Key in the first number; it is displayed on the calculator line. If necessary, press  $\text{[+/-]}$  to change the sign.
2. Press **[INPUT]** to enter the number as ITEM(1). Line 3 displays the updated running total, and the list pointer now points to ITEM(2).

\* The HP-18C can store two types of number lists—SUM and CFLO.

**Figure 6-3. SUM List After Entering One Number**

```
ITEM(1)=267.82
►ITEM(2)=
TOTAL=267.82
CALC INSERT DELET NAME GET
```

3. To enter ITEM(2), key in the value and press **INPUT**. The updated running total is displayed on the calculator line, and the list pointer now points to ITEM(3).

**Figure 6-4. SUM List After Entering Two Numbers.**

```
ITEM(2)=837.23
►ITEM(3)=
TOTAL=1,105.05
CALC INSERT DELET NAME GET
```

4. Continue entering values for ITEM(3), ITEM(4), etc. The HP-18C recognizes the end of the list when an item is left blank (no value is entered).

---

## **Viewing and Editing the List**

The **↑** and **↓** keys move the list pointer up and down the list one number at a time. **[ ]↑** and **[ ]↓** move the pointer to the beginning and end of the list. Moving the list pointer does not affect the value of the running total.

To change an incorrect number after it has been entered into the number list:

1. Position the list pointer at the incorrect value.
2. Key in the correct value and press **INPUT**. The correct value is entered into the list, and the updated running total is displayed.

To add a number to the bottom of the list, move the pointer to the bottom of the list (press **[ ]↓**) and enter the new value.

Inserting and deleting numbers are covered in chapter 7.

**Example: Updating a checkbook.** On May 30, a checking account balance was \$267.82. The transactions for the first 10 days in June are:

Date	Transaction	Amount	Date	Transaction	Amount
6/1	Balance	267.82	6/3	Check	-128.90
6/1	Deposit	837.42	6/7	Check	-65.35
6/1	Check	-368.23	6/10	Deposit	55.67
6/2	Check	-45.36			

Update the checkbook by calculating the running balance.

Starting from the MAIN menu:

Keys:	Display:	Description:
SUM *	►ITEM(1)= TOTAL=0,00	Displays the SUM menu.
CLEAR ALL		Clears the number list.
YES	►ITEM(1)= TOTAL=0,00	
267.82 INPUT	ITEM(1)=267.82 ►ITEM(2)= TOTAL=267.82	Enters the beginning balance.
837.42 INPUT	ITEM(2)=837.42 ►ITEM(3)= TOTAL=1,105.24	Enters the deposit on 6/1.
368.23 +/- INPUT 45.36 +/- INPUT 128.90 +/- INPUT 65.35 +/- INPUT 55.67 INPUT	ITEM(7)=55.67 ►ITEM(8)= TOTAL=553.07	Enters the remaining transactions.

\* If you want to preserve the current number list, skip the next step (pressing [CLEAR ALL]). Instead, name the list (refer to page 111), and then press [GET] \*NEW.

## Statistics Calculations With SUM Lists

Press **CALC** to display the CALC menu, which is described in table 6-2. To display a particular statistical value, press the appropriate menu key.

**Table 6-2. The CALC Menu for SUM Lists**

Menu Key	Description
<b>TOTAL</b>	Displays the sum of all the numbers in the list.
<b>MEAN</b>	Displays the mean (arithmetic average) of the set of numbers.
<b>MEDN</b>	Displays the median. If you were to sort the numbers from smallest to the largest, the median number would be half-way down the list. If there is an even number of items, the median is the mean of the middle two numbers.
<b>STDEV</b>	Displays the standard deviation.* The standard deviation is a measure of how dispersed the numbers are about the mean. The larger the standard deviation, the larger the spread. A standard deviation of 0 means that all the numbers are identical.
<b>RANG</b>	Displays the difference between the largest and smallest number.
	 A small rectangular button labeled "MORE" with a downward-pointing arrow on its left side and an upward-pointing arrow on its right side, indicating that more menu items are available below the current list.
<b>MIN</b>	Displays the smallest (minimum) number in the list.
<b>MAX</b>	Displays the largest (maximum) number in the list.
<b>SORT</b>	Sorts the list so that numbers are ordered from smallest to largest.
<b>FRCST</b>	Displays the FRCST (forecast) menu, which is used to do curve fitting and forecasting using the linear, exponential, logarithmic, or power models.

\* The formula used by the HP-18C calculates the *sample* standard deviation. The formula assumes that the list of numbers is a sampling of a larger, complete set of data. If the list is, in fact, the entire set of data, the *true population standard deviation* can be computed by calculating the mean of the original list, placing that value into the list, and then calculating the standard deviation.

**Example: Statistics calculations.** The Wechsler-Ellendman Canal Boat Shoe Shop had the following phone bills during the past six months:

Month	Phone Expense	Month	Phone Expense
1. May	\$340	4. August	\$780
2. June	\$175	5. September	\$245
3. July	\$450	6. October	\$625

Calculate the mean, median, and standard deviation of the monthly phone bills. Then, display the smallest value in the list.

Starting from the MAIN menu:

Keys:	Display:	Description:
SUM *		Displays the SUM menu.
<input type="checkbox"/> [CLEAR ALL] YES	►ITEM(1)= TOTAL=0.00	Clears the list.
340 [INPUT]	►ITEM(1)=340.00 ►ITEM(2)= TOTAL=340.00	Enters May's phone bill.
175 [INPUT]	►ITEM(2)=175.00 ►ITEM(3)= TOTAL=515.00	Enters June's phone bill.
450 [INPUT] 780 [INPUT] 245 [INPUT] 625 [INPUT]	►ITEM(3)= TOTAL=515.00 ►ITEM(4)= TOTAL=760.00 ►ITEM(5)= TOTAL=1005.00 ►ITEM(6)= TOTAL=1625.00 ►ITEM(7)= TOTAL=2,615.00	Enters the phone bills for July through October.

\* If you want to preserve the current number list, skip the next step (pressing  [CLEAR ALL]). Instead, name the list (refer to page 111), and then press  GET \*NEW.

<b>CALC</b>	<b>2,615.00</b>	Displays the CALC menu.
<b>MEAN</b>	<b>MEAN=435.83</b>	Calculates the mean.
<b>MEDN</b>	<b>MEDIAN=395.00</b>	Calculates the median.
<b>STDEV</b>	<b>STDEV=231.55</b>	Calculates the standard deviation.
<b>MORE</b>		Displays the rest of the CALC menu.
<b>MIN</b>	<b>MIN=175.00</b>	Displays the smallest number.

## Curve Fitting and Forecasting

Curve fitting is a technique for finding a mathematical relationship between two sets of numbers. The two sets of numbers are referred to as x-values and y-values. Curve fitting uses two SUM number lists—one for the x-values and one for the y-values. You can select one of four relationships (or models\*), which are illustrated in figure 6-5:

- Linear;  $y = A + Bx$  ( $A$  is the y-intercept,  $B$  is the slope of the line).
- Logarithmic;  $y = A + B \ln x$  (all x-values must be positive).
- Exponential;  $y = Ae^{Bx}$  (all y-values must be positive).
- Power curve;  $y = Ax^B$  (all x-values and all y-values must be positive).

The HP-18C uses the x- and y-values to calculate  $A$ ,  $B$ , and the correlation coefficient. The correlation coefficient measures how well the calculated curve describes your data. Once the curve has been calculated, it can be used to do forecasting (what if?) calculations.

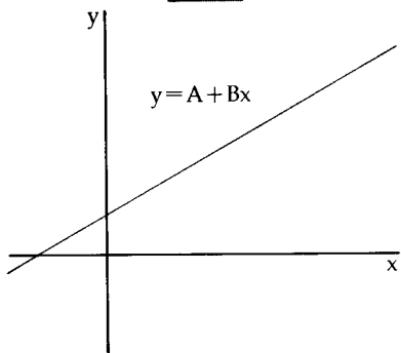
\* The HP-18C calculates the exponential, logarithmic, and power models using transformations that allow the data to be fitted by standard linear regression. These transformations are:

- Logarithmic;  $y = A + B \ln x$ ;  $y$  versus  $\ln(x)$ .
- Exponential;  $\ln(y) = \ln(A) + Bx$ ;  $\ln(y)$  versus  $x$ .
- Power curve;  $\ln(y) = \ln(A) + B \ln(x)$ ;  $\ln(y)$  versus  $\ln(x)$ .

**Figure 6-5. Curve Fitting Models**

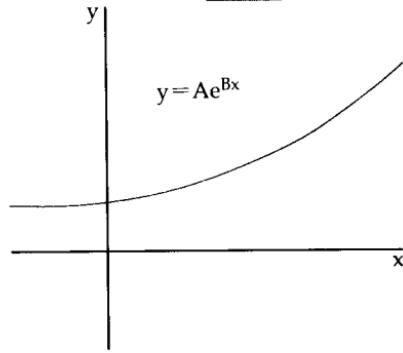
Linear Curve Fit

**LIN**



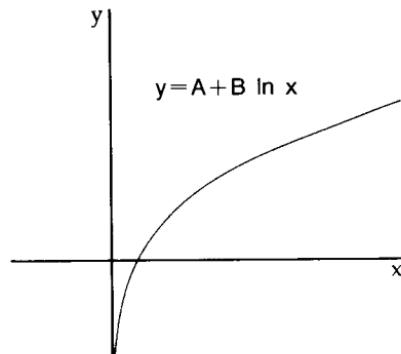
Exponential Curve Fit

**EXP**



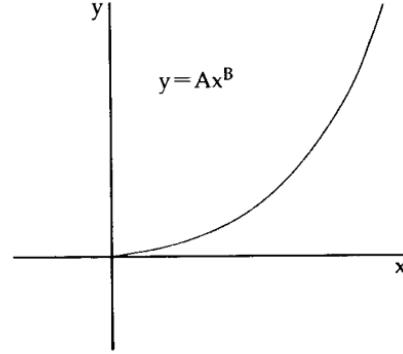
Logarithmic Curve Fit

**LOG**



Power Curve Fit

**PWR**



To do curve fitting and forecasting:

1. Prepare a SUM number list for the x-values. Give the list a name. If necessary, refer to chapter 7 for instructions for creating, naming, and switching number lists.
2. Prepare a SUM number list for the y-values. Naming this list is optional.
3. From the SUM menu (with the y-value list displayed) press **CALC** to display the CALC menu, then press **MORE**.
4. Press **FRCST**. The HP-18C displays a menu containing a label for each named SUM list in memory. If necessary, press **MORE** to see all the list names.
5. Press the menu key menu for the list containing the x-values. The HP-18C displays the FRCST menu.
6. Press the menu key for the model you want to use. The HP-18C displays the curve fitting menu (refer to table 6-3).
7. To display the curve fitting results, press **CORR**, **A**, and/or **B** (refer to table 6-3).
8. To do forecasting calculations:
  1. Key in a value and press the menu key for the known value—**XLIST** or **YLIST**.
  2. Press the menu key for the value you are forecasting.

**Table 6-3 The Curve Fitting Menu**

Menu Key	Description
XLIST YLIST	Estimates an x-value based on a y-value or a y-value based on an x-value.
CORR *	Displays the <i>correlation coefficient</i> . The correlation coefficient is a number between $-1$ and $+1$ that measures how closely the x,y-values match the calculated curve.* A correlation coefficient close to $+1$ or $-1$ indicates that the x,y-values lie close to the calculated curve; a correlation coefficient close to $0$ indicates the curve is a poor fit to the values.
A *	Displays the value of <i>A</i> for the model. (For the linear model, this is the y-intercept of the line.)
B *	Displays the value of <i>B</i> for the model. (For the linear model, this is the slope of the line.)

\* Calculated using the transformed formulas for the exponential, logarithmic, and power models.

**Example: Curve fitting.** Bolden's Health Foods advertises on a local radio station. For the past six weeks, the manager has kept records of the number of minutes of advertising that were purchased, and the sales for that week:

	Number of Minutes of Radio Advertising Purchased (x-Values)	Dollar Sales (y-Values)
Week 1	2	\$1,400
Week 2	1	\$ 920
Week 3	3	\$1,100
Week 4	5	\$2,265
Week 5	5	\$2,890
Week 6	4	\$2,200

Bolden's wants to determine whether there is a linear relationship between the amount of radio advertising purchased and the weekly sales.

**Part 2.** If a strong relationship exists, Bolden's wants to use the relationship to forecast sales.

Starting from the MAIN menu:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
SUM *		Displays the SUM menu.
CLEAR ALL		Clears the number list.
YES	►ITEM(1)= TOTAL=0.00	
2 INPUT		Enters the number of minutes of advertising (x-values) into a SUM number list.
1 INPUT		
3 INPUT		
5 INPUT		
5 INPUT		
4 INPUT	ITEM(6)=4.00 ►ITEM(7)= TOTAL=20.00	
NAME		This message is briefly displayed.
MINUTES		
INPUT	NAME IS NOW: ►MINUTES	
GET *NEW	►ITEM(1)= TOTAL=0.00	Switches to a new, empty list.

\* If you want to preserve the current number list, skip the next step (pressing [CLEAR ALL]). Instead, name the list (refer to page 111), and then press [GET] [\*NEW].

1400	<b>INPUT</b>	Enters the weekly sales (y-values) into a SUM number list.	
920	<b>INPUT</b>		
1100	<b>INPUT</b>		
2265	<b>INPUT</b>		
2890	<b>INPUT</b>		
2200	<b>INPUT</b>	ITEM(6)=2,200.00 ►ITEM(7)= TOTAL=10,775.00	
<b>NAME</b>	<b>SALES</b>	The message is briefly displayed.	
<b>INPUT</b>	NAME IS NOW: ►SALES		
<b>CALC</b>	<b>MORE</b>	Selects MINUTES as the list containing the x-values, and displays the FRCST menu.	
<b>FRCST</b>	<b>MINU</b>		
<b>LIN</b>		Selects the linear model.	
<b>CORR</b>	CORR=0.90	Displays the correlation coefficient for the linear model.	
7	<b>XLIST</b>	XLIST=7.00	Stores 7 in variable XLIST.
<b>YLIST</b>		YLIST=3,357.38	Calculates the forecasted sales.

# Working With Number Lists

## Introduction

A *number list* is a collection of numbers used to perform various calculations. Table 7-1 describes the two types of number lists.

**Table 7-1. Types of Number Lists**

List Type	Type of Calculations Done	Reference
CFLO	Cash flows (IRR%, NPV, NUS, and NFV).	Chapter 5
SUM	Running total, statistics, curve fitting, forecasting.	Chapter 6

Entering numbers into number lists and doing calculations with them are covered in chapters 5 and 6. These menu keys are covered in chapter 7:

- INSRT** Used to insert a number into a list.
- DELET** Used to delete a number from a list.
- NAME** Used to name or rename a list; also displays the current list name.
- GET** Used to switch from one list to another.

Chapter 7 also covers clearing number lists.

---

## How Number Lists Are Stored

The HP-18C keeps track of number lists by their names and by the menu used to create them. For example, calculator memory might contain a CFLO number list named ACCT1 and a SUM list named CHKBK.

The quantity and size of the lists you can store is limited only by the amount of calculator memory. The larger the number list, the more memory it requires.

---

## Inserting a Number Into a List

To insert values into a list:

1. Position the list pointer below the place of insertion. For example, to insert a number between ITEM(6) and ITEM(7), place the list pointer at ITEM(7).
2. Press **INSRT**.
3. Key in the value for the item or cash flow and press **INPUT**. For CFLO lists, also enter #TIMES.

---

## Deleting a Number From a List

To delete a number from a list, position the list pointer at the number you want to delete and press **DELET**. For CFLO lists, both the FLOW and the #TIMES are deleted.

---

## **Copying a List Number to the Calculator Line**

To copy a number in the list into the calculator line, position the list pointer at that number and press **RCL** **INPUT**.

---

## **Creating New Number Lists**

A number list is created when:

- The HP-18C displays the CFLO and SUM menus for the first time.
- You create a list by pressing **GET**, then **\*NEW**.

When a list is created, it is empty and nameless. The HP-18C allows you to have, at most, one nameless list of each type.

---

## **Naming and Renaming Number Lists**

A new number list has no name. Providing the list with a name helps you to locate it later, and also enables you to have more than one list of a particular type (for example, more than one SUM list).

To name a list:

1. Press **NAME**.
2. Type the name and press **INPUT**.

List names can be up to 22 characters long and can include any characters. The first four or five characters (some letters are wider than others) of the name become a menu label in the GET menu. For example, if you had three CFLO number lists named LOAN, LANDSALE, and LEASEPMTS, pressing **GET** in the CFLO menu would display the menu shown in figure 7-1.

**Figure 7-1. List Names Displayed in the GET Menu**



To change the name of the current list:

1. Press **NAME**. The current name is displayed on line 3.
2. Edit the current name using the alphabetic editing keys. Or, clear the calculator line (press **CLEAR**) and type the new name.
3. Press **INPUT**.

A list can remain nameless until you want to display (GET) a different list in the same menu. Before you can switch from a nameless list to another list, you must name the list or clear it.

---

## **Viewing the List Name**

To view the current list name:

1. Press **NAME**. The list name is displayed on line 3.
2. Press **EXIT** to return to the previous menu.

---

## **Switching Number Lists (GET)**

When you press **EXIT** or **MAIN** to leave a CFLO or SUM menu, the HP-18C remembers which list you were using. When you reenter the menu, the same list is displayed.

To get a different list of the same type:

1. Press **GET**. The GET menu contains a menu label for each named list of that type (see figure 7-1), plus **\*NEW**.\*
2. Press the appropriate menu key. Pressing **\*NEW** displays a new, empty list.

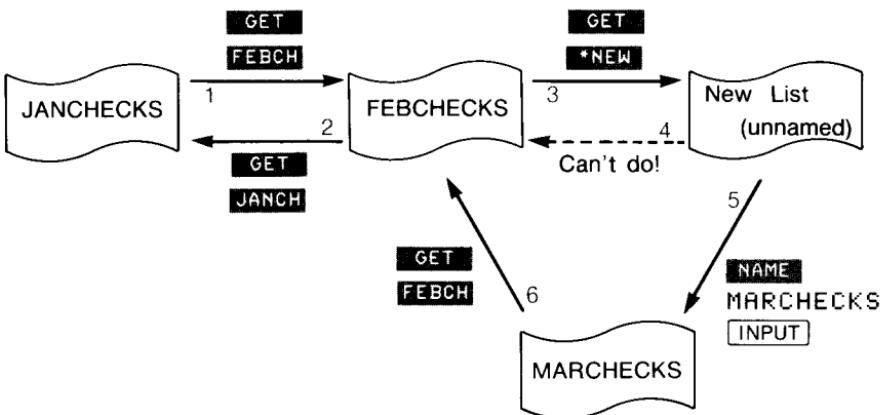
Figure 7-2 illustrates switching between two number lists named JANCHECKS and FEBCHECKS, creating a new list, and naming that list. Notice that you cannot switch from a nameless list. If your current list contains numbers and is nameless, pressing a menu key in the GET menu displays:

CURRENT LIST UNNAMED;  
NAME OR CLEAR THE LIST

and the HP-18C returns to the previous menu. To name the list, press **NAME**. To clear the list, press **CLEAR ALL**.

\* If pressing **GET** causes the HP-18C to display the message **INSUFFICIENT MEMORY** and an abbreviated GET menu (there will be only one menu label and no **\*NEW** label), you should exit the GET menu, complete any arithmetic (calculator line) calculations you were in the process of doing (press **=** or **CLEAR**), and then try pressing **GET** again. If there is still insufficient memory to display the entire GET menu, the HP-18C displays one menu label (list name). If this is not the list you want, press the menu key and then press **GET** again to display another list name. Continue this procedure until you've switched to the desired list.

**Figure 7-2. Switching Between Number Lists**



- (1) Switching from a list named JANCHECKS to a list named FEBCHECKS.
- (2) Switching from a list named FEBCHECKS to a list named JANCHECKS.
- (3) Creating a new list.
- (4) You cannot switch from a nameless list until you've named the list or cleared it.
- (5) Naming a list MARCHECKS.
- (6) Switching from a list named MARCHECKS to a list named FEBCHECKS.

---

## Clearing a Number List

Clearing a number list erases all the numbers in the list, returning it to its empty state. The memory used by the list becomes available for other information.

To clear the currently displayed number list, press **CLEAR ALL**, then **YES**. If you previously named the list, the HP-18C lets you choose whether or not to clear the name by displaying:

ALSO CLEAR THE  
LIST NAME?

Pressing **YES** displays an empty, nameless list. Pressing **NO** retains the name, and you will be viewing the empty, named list.

## Time, Alarms, and Date Arithmetic

### Introduction

The HP-18C contains a clock and calendar, which are used by the TIME menu. The TIME menu allows you to:

- Display the current time, date, and day of the week.
- Set and adjust the time and date.
- Select the formats for displaying the time (12-hour or 24-hour) and date (month/day/year or day.month.year).
- Set alarms with optional messages.
- Determine the day of the week for a particular date.
- Calculate the number of days between two dates, using the 360-day, 365-day, or actual calendar.

The HP-18C calendar runs from October 15, 1582 to December 31, 9999.

### Viewing the Time and Date

To view the time, date, and day of the week, press **TIME** in the MAIN menu.

**Figure 8-1. The TIME Menu and Display**

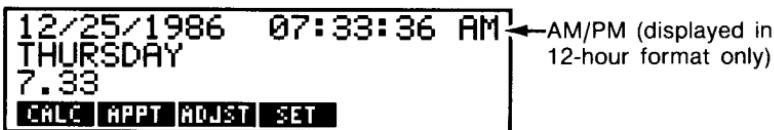


Table 8-1 describes the TIME menu keys.

**Table 8-1. TIME Menu Keys**

Menu Key	Description
<b>CALC</b>	Displays the CALC menu, which is used to calculate the number of days between two dates or the date a specified number of days before or after a given date; also used to determine the day of the week for any date.
<b>APPT</b>	Displays the APPT menu, used to set and view appointment alarms.
<b>ADJST</b>	Displays the ADJST menu for adjusting the clock setting.
<b>SET</b>	Displays the SET menu for setting the time and date; also selects the time and date formats.

---

## Setting the Time and Date

The SET menu is used to set the time and date and to change the time and date formats. Table 8-2 describes the SET menu.

To set the time, from the MAIN menu:

1. Press **TIME**, then **SET** to display the SET menu. Note the current time format—AM or PM after the time indicates 12-hour format.
2. Using the current format, key in the correct time\* as a number in the form HH.MMSS. For example 9:08:30 PM would be keyed in as 9.0830 (12-hour format) or 21.0830 (24-hour format).
3. Press **TIME**. The clock is now set to the new time.
4. For 12-hour format only: If necessary, press **A/PM** to switch between AM and PM.

\* To set the exact time from a time standard, key in an HH.MMSS value 15 to 30 seconds in the future. Press **TIME** when the two times match.

To set the date:

1. Note the current date format. If the date contains slashes (for example, 10/23/89), the current format is month/day/year. If the date contains periods (for example, 23.10.1989), the current format is day.month.year.
2. Key in the correct date as a seven- or eight-digit number, using the current format. For example, April 3, 1987 would be 4.031987 (MM.DDYYYY) in month/day/year format or 3.041987 (DD.MMYYYY) in day.month.year format.
3. Press **DATE**.

**Table 8-2. SET Menu Keys**

Menu Key	Description
<b>DATE</b>	Enters the number in the calculator line as the current date.
<b>TIME</b>	Enters the number in the calculator line as the current time.
<b>A/PM</b>	In 12-hour format, switches the clock setting between AM and PM.
<b>M/D</b>	Switches between month/day/year format and day.month.year format.
<b>12/24</b>	Switches between 12-hour and 24-hour time formats.
<b>HELP</b>	Displays the keystrokes for keying in the time and date.

**Example: Setting the date and time.** Set the date and time to June 9, 1987, 4:07 p.m.

Starting from the MAIN menu:

<b>Keys:</b>	<b>Displays:</b>	<b>Description:</b>
<b>TIME</b>		Displays the current settings
<b>SET</b>		Displays the SET menu.
6.091987 <b>DATE</b>	06/09/1987	Date is displayed on line 1.
4.07 <b>TIME</b> <b>A/PM</b> *	04:07:xx PM	Time is displayed on line 1.

---

## Changing the Time and Date Formats

Use the SET menu to change the time and date formats (from the MAIN menu, press **TIME**, then **SET**). To switch between the 12- and 24-hour time format, press **12/24**. To switch between month/day/year and day.month.year format, press **M/D**.

---

## Adjusting the Clock Setting

The ADJST menu adjusts the time setting forward or backward in increments of hours, minutes, or seconds.

To adjust the time setting, from the TIME menu:

1. Press **ADJST**.
2. Press the appropriate menu key(s) until the correct time is displayed. For example, if the current time setting is 11:20:xx AM (ignoring seconds), pressing **+HR** twice changes the time to 1:20 PM. Then, pressing **-MIN** three times changes the time to 1:17 PM.

\* Press only if previous time setting was AM.

## Alarms

The HP-18C has six alarms. To set an alarm, you store the date and time that you want the alarm to go off, plus an optional message. You can also designate repeating alarms—alarms that go off at regular intervals.

### Viewing and Setting an Alarm

To set an alarm or view the current setting of an alarm, starting from the MAIN menu:

1. Press **TIME**, then **APPT**. The APPT menu contains a menu label for each of the six alarms.

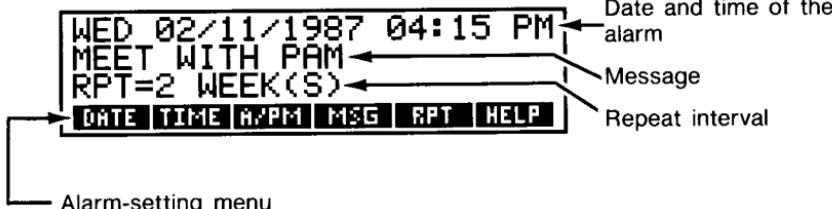
**Figure 8-2. The APPT Menu With Two Alarms Pending and One Past Due**



*Pending alarms* are those set to some future time. *Past due* alarms are those that went off and have not been acknowledged. All other alarms are *expired*; they were acknowledged when they went off sometime in the past, or they have been cleared.

2. Press a menu key—**APPT1** through **APPT6**. The display shows the current setting for that alarm and the alarm-setting menu described in table 8-2.

**Figure 8-3. The Current Settings of an Alarm**



**Table 8-2. The Alarm-Setting Menu Keys.**

Menu Key	Description
DATE	Enters the number on the calculator line as the alarm date.
TIME	Enters the number on the calculator line as the alarm time.
A/PM	In 12-hour time mode, sets AM or PM.
MSG	Used to type an alarm message.
RPT	Displays the RPT (repeat) menu, which is used to set the repeat interval.
HELP	Displays the keystrokes for setting the alarm time and date.

3. Press **CLEAR ALL** to clear the previous alarm settings.
4. If you are uncertain how to key in the time or date, press **HELP**.
5. Key in the date of the alarm as a number, using the current date format. For example, October 4, 1988 would be 10.041988 (month/day/year format) or 4.101988 (day.month.year format). Press **DATE**. If you omit the year, the calculator assumes the current year.
6. Note the time format in use—AM or PM after the time indicates 12-hour format. Key in the time of the alarm as a number in the form HH.MMSS. For example, 2:25 p.m. would be 2.25 (12-hour format) or 14.25 (24-hour format).
7. For 12-hour format only: If necessary, press **A/PM** to switch between AM and PM.
8. If you want to store a message, press **MSG**. Type the message and press **INPUT**. Messages are limited to a maximum of 22 characters.

9. If you want the alarm to repeat at a particular interval, press **RPT** to display the RPT menu. Key in an integer and press the appropriate key. For example, 2 **DAY** causes the alarm to go off at the same time every other day; 90 **MIN** sets the repeat interval to 1½ hours. **NONE** restores the alarm to non-repeating. You can specify repeat intervals up to 104 weeks in length (728 days, 17,472 hours, etc.)
10. Press **EXIT** to return to the APPT menu. The alarm you just set will be listed as a pending alarm.

## **Editing Alarm Settings**

When the HP-18C is displaying the alarm-setting menu, you can edit any of the settings. To erase the message, press **MSG** **CLEAR** **INPUT**. To change the alarm from a repeating alarm to a non-repeating alarm, press **RPT** **NONE**.

## **Acknowledging an Alarm**

When an alarm “comes due,” the HP-18C beeps and the alarm annunciator comes on.\* If the alarm has a message, it is displayed on line 1; otherwise, the HP-18C displays the date and time of the alarm.

To acknowledge the alarm and clear the message, press any key while the HP-18C is beeping. Alarms not acknowledged within 20 seconds become past due.

If the calculator is turned off when an alarm comes due, it turns itself on to announce the alarm. If you do not acknowledge the alarm within 20 seconds, the alarm becomes past due.

\* If the HP-18C is in the middle of a complex calculation when an alarm comes due, the alarm annunciator comes on and the calculator beeps once. When the calculation is done, the HP-18C displays the message and resumes beeping for 20 seconds.

## **Unacknowledged Alarms**

If an alarm is not acknowledged within 20 seconds, the beeping stops and the alarm is classified as past due (unacknowledged). The alarm annunciator ((●)) remains on to inform you that you have a past due alarm.

To acknowledge a past due alarm, from the MAIN menu:

- 1.** Press **TIME**, then **APPT**. The display lists any past due alarms.
- 2.** Press the menu key for the past due alarm.
- 3.** Press **EXIT** to return to the APPT menu. Note that the acknowledged alarm is no longer listed as past due.

A repeating alarm is deactivated while it is past due. It will not go off at subsequent repeat intervals until the alarm has been acknowledged.

## **Clearing Alarms**

Clearing an alarm changes it into an expired, non-repeating alarm with no message. The alarm is “set” to 00/00/0000, 12:00 AM.

To clear a particular alarm, from the MAIN menu:

- 1.** Press **TIME**, then **APPT**.
- 2.** Press the menu key for the appropriate alarm.
- 3.** Press **CLEAR ALL**.

To clear all six alarms:

- 1.** Press **TIME**, then **APPT**.
- 2.** Press **CLEAR ALL** **YES**.

**Example: Setting and clearing an alarm.** Today is Friday, April 15, 1988. You want to set an alarm to go off every Tuesday at 2:15 p.m. to remind you of a staff meeting. The example assumes 12-hour time format and month/day/year date format.

Starting from the MAIN menu:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
TIME APPT		Displays the APPT menu.
APPT4		Displays the alarm-screen and menu for alarm #4.
CLEAR ALL		Clears the alarm.
4.19 DATE	TUE 04/19/1988	Stores the alarm date.
2.15 TIME	02:15 AM	Stores the alarm time.
A/PM	02:15 PM	Sets the alarm time to PM.
MSG STAFF MEETING	STAFF MEETING	Enters the message.
INPUT		
RPT		Displays the RPT (repeat) menu.
1 WEEK	RPT=1 WEEK(S)	Sets the repeat interval to one week.
EXIT		Displays the APPT menu. Alarm #4 is listed as pending.

---

## Date Arithmetic

The CALC menu is used to do date arithmetic—finding the number of days between two dates, or determining the date a given number of days in the future or past. Date arithmetic uses one of three calendars—actual, 365-day, or 360-day (refer to table 8-3). You can also use the CALC menu to determine the day of the week for any date.

To display the CALC menu, from the MAIN menu, press **TIME**, then **CALC**.

**Table 8-3. The CALC Menu for Date Arithmetic**

Menu Key	Description
<b>DATE1</b>	Stores or calculates a date, using the current date format—month/day/year (MM.DDYYYY) or day.month.year (DD.MMYYYY); also displays the day of the week. If you omit YYYY, the calculator uses the current year.
<b>DATE2</b>	
<b>DAYS</b>	Stores or calculates the number of days between DATE1 and DATE2, using the actual calendar. The actual calendar recognizes leap years.
<b>360D</b>	Calculates the number of days between DATE1 and DATE2, using the 360-day calendar. The 360-day calendar is based on 30-day months.
<b>365D</b>	Calculates the number of days between DATE1 and DATE2, using the 365-day calendar. The 365-day calendar ignores leap years.
<b>TODAY</b>	Displays the current date, which can then be stored in DATE1 or DATE2.

## Determining the Day of the Week For Any Date

To find the day of the week for any date, key in the date and press **DATE1** or **DATE2**.

## Calculating the Number of Days Between Dates

To calculate the number of days between two dates, starting from the CALC menu:

1. Key in the first date in the current date format and press **DATE1**.
2. Key in the second date and press **DATE2**.
3. Press **DAYS**, **360D**, or **365D** to calculate the number of days using that calendar.

### Example: Calculating the number of days between two dates.

Find the number of days between April 20, 1949 and August 2, 1986, using both the actual calendar and the 365-day calendar. Assume the date format is month/day/year.

Starting from the MAIN menu:

Keys:	Display:	Description:
<b>TIME</b> <b>CALC</b>		Displays the CALC menu.
4.201949		
<b>DATE1</b>	DATE1= 04/20/1949 WED	Stores the first date and displays day of the week.
8.021986		
<b>DATE2</b>	DATE2= 08/02/1986 SAT	Stores the second date.
<b>DAYS</b>	ACTUAL DAYS= 13,618.00	Calculates the number of days using the actual calendar.
<b>365D</b>	365 DAYS=13,609.00	Calculates the number of days using the 365-day calendar.

## Determining Past or Future Dates

The HP-18C can determine the date a specified number of days from another date using the actual calendar. To calculate a date:

1. Key in the known date in the current date format and press **DATE1**.
2. Key in the number of days. If the unknown date precedes the known date, press **+/-**. Press **DAYS**.
3. Press **DATE2**.

**Example: Determining a future date.** On February 9, 1987, you purchase a 120-day option on a piece of land. Determine the expiration date. Assume the date format is month/day/year.

Starting from the MAIN menu:

Keys:	Display:	Description:
<b>TIME</b> <b>CALC</b>		Displays the CALC menu.
2.091987		Stores DATE1.
<b>DATE1</b>	DATE1=	
	2/09/1987 MON	
120 <b>DAYS</b>	ACTUAL DAYS=120.00	Stores the number of days in the future.
<b>DATE2</b>	DATE2=	Calculates the expiration date.
	6/09/1987 TUE	

## Clearing the Date Arithmetic Variables

When the HP-18C is displaying the CALC menu, pressing **CLEAR ALL** clears DATE1, DATE2, ACTUAL DAYS, 360 DAYS, and 365 DAYS to 0. The date arithmetic variables are also cleared whenever you press **CALC** in the TIME menu.

# The Formula Solver

## Introduction

The formula solver (the SOLVE menu) creates *custom menus* from formulas you enter and uses those custom menus to do calculations.

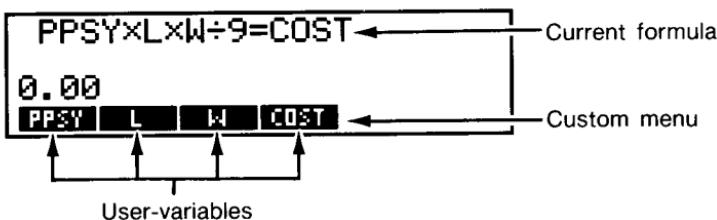
For example, suppose you frequently buy carpet and must calculate how much it will cost. The price is quoted to you per square yard. Regardless of how you are doing the calculation (even if you are doing it long-hand), you are using a formula.

$$\frac{\text{Price per square yard} \times \text{Length (feet)} \times \text{Width (feet)}}{9} = \text{COST}$$

↑  
Converts square feet to square yards

The SOLVE menu lets you type in this formula. When you press **CALC**, the HP-18C's solver creates a custom menu for doing the calculation. Figure 9-1 illustrates the custom menu created from the "carpet" formula.

**Figure 9-1. A Custom Menu in SOLVE**



Each menu label represents a *user-variable* created by the solver. You can store numbers into these variables and do calculations the same way you use other menus and their built-in variables.

**Example: Entering a formula and using a custom menu. Part 1.**

Use the formula on page 127 to create the custom menu shown in figure 9-1. Then, calculate the cost of carpet needed to cover a 9' by 12' room. The carpet costs \$22.50 per square yard.

**Part 2.** Determine the most expensive carpet you can buy if the maximum amount you can pay to carpet the room is \$300.

Starting from the MAIN menu:

Keys:	Display:	Description:
SOLVE [ ] [ ]	►	Displays the SOLVE menu and bottom of the formula list.
PPSY [x] L [x] W [÷] 9 [=] COST	► PPSY×L×W÷9=COST	Formula typed into calculator line.*
CALC		Enters the formula and displays the custom menu.
22.50 PPSY	PPSY=22.50	Stores the price per square yard in PPSY.
9 [ ] W	W=9.00	Stores the width.
12 [ ] L	L=12.00	Stores the length.
COST	COST=270.00	Calculates the cost.
300 COST	COST=300.00	Stores \$300 in COST.
PPSY	PPSY=25.00	Calculates the maximum price per square yard you can pay.

\* You must use the multiplication key ([x]), and not the alphabetic [X] key, to enter the "times" sign.

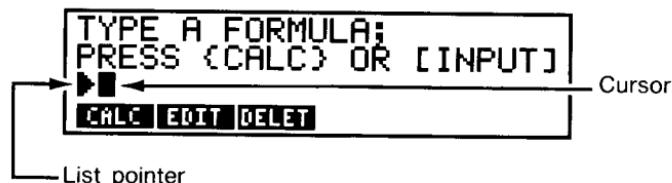
## The Formula List

The formulas you enter are stored into a *formula list*. The formula list can contain as many formulas as you'd like, limited only by the amount of unused calculator memory.

## The SOLVE Menu

To display the SOLVE menu from the MAIN menu, press **SOLVE**. If you haven't previously used the SOLVE menu, the formula list is empty and line 3 is ready to accept the formula you type.

**Figure 9-2. The Empty Formula List**



If the formula list already contains one or more formulas, the display will look different (see figure 9-3). The HP-18C displays a portion of the formula list. The list pointer points to the *current formula*—the formula the solver uses to create the custom menu when you press **CALC**. Lines 1 and 2 display the two formulas that precede the current formula. You can use  $\uparrow$  or  $\downarrow$  to designate a different current formula.

**Figure 9-3. The Formula List With Several Stored Formulas**



The SOLVE menu shows the operations you can do with the formula list. Table 9-1 briefly describes these operations.

**Table 9-1. SOLVE Menu Keys**

Menu Key	Description
<b>CALC</b>	Displays the custom menu for the current formula.
<b>EDIT</b>	Allows you to change a formula after it has been entered; also allows you to view an entire formula that is longer than 22 characters.
<b>DELET</b>	Displays the DELET menu, which is used to delete the current formula and/or its user-variables.

---

## Entering Formulas

To enter a formula into the formula list, starting from the MAIN menu:

1. Press **SOLVE**.
2. If the list is empty, go to step 3. If the list already contains one or more formulas, press **[ ] [▼]**\* to move the list pointer to the bottom of the formula list.
3. Type the formula. There is no limit on the length of the formula. When a line is full, it rolls up to make room for another line of characters. If you make a typing mistake, use the alphabetic editing keys. (The alphabetic editing keys are covered on pages 23 and 24.)
4. Do **a** or **b**:
  - a. Press **CALC** to enter the formulas and display the custom menu. The first 22 characters of current formula is at the top of the display.
  - b. Press **INPUT**. The cursor disappears and line 3 displays the list pointer and the first 22 characters of the formula. If you want to enter another formula, return to step 3.

\* If you skip this step, the new formula is inserted after the current formula.

When you press **INPUT** or **CALC**, the HP-18C displays:

**VERIFYING FORMULA...**

to indicate that the solver is checking the formula. If the formula cannot be interpreted, the HP-18C briefly displays:

**INVALID FORMULA**

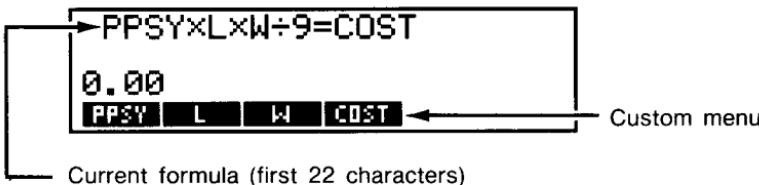
and the cursor is positioned before the first character the solver could not interpret. Check to be sure you've made no typing mistakes, and that you've followed the rules for writing formulas on pages 141 through 143.

---

## Calculations With Custom Menus

Pressing **CALC** displays the custom menu for the current formula. If the formula contains more than six user-variables, the solver creates the label **MORE** to switch between sets of menu labels.

**Figure 9-4. A Custom Menu**



To do a calculation using a custom menu:

1. Store a value in all but one of the user-variables. For example, in using the menu in figure 9-4, you can store values in PPSY, L, and W to calculate COST. Or, you can store values in PPSY, W, and COST to calculate L. To store a value, key in the number and press the appropriate menu key. For example, 22.50 **PPSY** stores the value 22.50 in PPSY.
2. To start the calculation, press the menu key for the value you want to calculate. If the solver is able to find a solution to the formula, the answer is displayed on the calculator line.

In most cases, this is all you will need to know about how the solver works. However, there are certain types of formulas that are more difficult to solve. If, during the calculation, the history stack is overwritten by sets of changing numbers (see figure B-1 on page 174), you should read the section, **How the Solver Works** starting on page 137.

---

## Clearing User-Variables

Clearing user-variables sets them equal to 0 and clears the history stack. To clear a set of user-variables associated with a particular custom menu, display the custom menu and press **CLEAR ALL**.

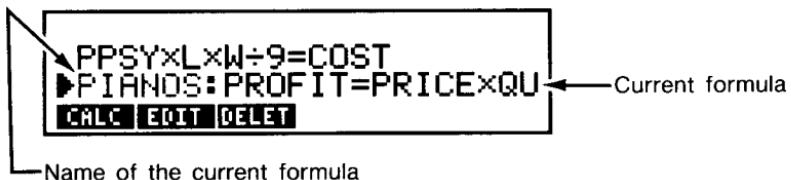
User-variables are also cleared when the formula is edited.

---

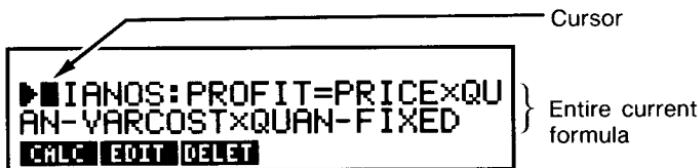
## Viewing Long Formulas

The formula list shows only the first 22 characters of a formula. To view the entire current formula, press **EDIT**. The entire formula (up to 68 characters) is displayed (see figures 9-5 and 9-6). If the formula is longer than 68 characters, use **↓** to see the rest of the formula. When you are done viewing the formula, press **EXIT**.

**Figure 9-5. A Formula List**



**Figure 9-6. The Entire Current Formula.**



## Editing a Formula

To change the current formula:

1. Press **EDIT** to display the entire formula and cursor.
2. Make the necessary changes. You can use all the alphabetic editing keys (refer to table 1-1 on page 24).
3. Press **INPUT** or **CALC** to replace the previous version with the edited version.

Editing a formula clears its user-variables.

To abort an editing operation after you've pressed **EDIT**, press **EXIT**.

---

## Naming a Formula

Naming formulas helps you identify them later. Figure 9-7 shows a formula list containing two named formulas and one unnamed formula. The name precedes the formula; a colon separates the name from the beginning of the formula.

**Figure 9-7. Formula Names**



Formula names

To name a formula, type in the name before you type in the formula. Separate the name from the formula with a colon (:). For example, to enter the formula PRICE = INVOICE × DISCOUNT, and name it DISCTPRICE, type:

DISCTPRICE : PRICE [=] INVOICE [x] DISCOUNT.

If you type in a formula without a name, you can add a name later using the **EDIT** key.

Names can be any length and can include any characters except +, -, ×, ÷, ), (, <, >, ^, :, =, and space.

---

## Shared User-Variables

If two or more formulas contain the same user-variable, that variable is *shared* among the formulas in which it appears. For example, suppose your formula list includes these two formulas named CARPETPRICE and TOTALPRICE:

CARPETPRICE:PPSYxLxW÷9=COST

TOTALPRICE:COST+HOURS×20.50=CHARGE

COST is a shared user-variable. You can calculate a value for COST using the custom menu for CARPETPRICE, and then switch to the custom menu for TOTALPRICE. Since the value for COST is shared, you do not need to store it again. After entering HOURS, you can calculate CHARGE.

No sharing occurs between built-in variables and user-variables. For example, the COST user-variable in the formula solver is not shared with the COST built-in variable in the MU%C and MU%P menus.

---

## **Deleting the Current Formula and/or Its User-Variables**

Each formula in the formula list uses calculator memory to store the formula and the user-variables in the formula. For example, the formula:

$\text{PPSY} \times \text{L} \times \text{W} \div 9 = \text{COST}$

uses five storage locations. One location stores the formula; four locations store the user-variables PPSY, L, W, and COST. Deleting the variables frees the storage locations used to store PPSY, L, W, and COST. Deleting both the variables and the formula frees these four locations, plus the location used to store the formula.

To delete the user-variables, or both the user-variables and the formula:

1. Press **DELET** to display the **DELETE** menu.
2. Do **a** or **b**:
  - a. Press **VARS** to delete the user-variables associated with the current formula. The user-variables are created again the next time you use the formula. If the user-variable is a shared variable, its value is lost to all the formulas that share it.
  - b. Press **BOTH** to delete the current formula and its user-variables.

## **Deleting All Formulas and/or Their User-Variables**

To delete the user-variables in all the formulas, or to delete all the formulas and their user-variables:

1. Display the SOLVE menu and press **[CLEAR ALL]**.
2. Do **a** or **b**:
  - a. To delete the user-variables in all the formulas, press **VARS**.
  - b. To delete all the user-variables and all the formulas, press **BOTH**.

---

## **Summary of Clear and Delete Operations**

Table 9-2 summarizes the various ways to clear and delete information that is stored using the solver.

**Table 9-2. Summary of Clear and Delete Operations**

To do this:	Display this menu:	And press:
Clear (set to 0) the user-variables in the current formula	Custom menu for the formula (by pressing <b>CALC</b> )	<b>[CLEAR ALL]</b>
Delete the user-variables for the current formula	SOLVE	<b>DELET</b> <b>VARS</b>
Delete both the current formula and its user-variables	SOLVE	<b>DELET</b> <b>BOTH</b>
Delete all the user-variables in memory	SOLVE	<b>[CLEAR ALL]</b> <b>VARS</b>
Delete all the formulas in the list and all user-variables	SOLVE	<b>[CLEAR ALL]</b> <b>BOTH</b>

## How the Solver Works

The solver has two ways of finding an answer. First, the solver tries to find a *direct* solution by rearranging the formula and then solving for the variable. If the solver finds a direct solution, the HP-18C displays the answer on the calculator line, and no other information is displayed.

If the solver is unable to find a direct solution, the solver tries to find the answer *numerically*. This involves searching for the answer by estimating a set of answers, seeing how close they are to a solution, and then making another set of estimates. The HP-18C displays the current estimates while the solver is searching for an answer numerically. You should keep in mind that *there may be more than one solution to a formula*, and that it may be necessary for you to enter guesses in order to influence which solution the solver finds. If the displayed estimates don't appear to be proceeding towards a number you judge to be a reasonable answer, you may want to stop the numerical process, enter your own guesses, and restart the search (refer to **Halting and Restarting the Numerical Search**, and **Entering Guesses** on page 138).

Since the process of finding a numerical solution is very complex, there are four possible outcomes that you should be aware of. If necessary, refer to **Solver Calculations** on page 171 for additional descriptions of these possible outcomes.

- **Case 1:** The HP-18C displays an answer on line 3 and there is no message in lines 1 and 2. It is very likely that the solver has found a solution. The 18-C may display additional information if you repeat the calculation by pressing the menu key for the variable you solved for. If repeating the calculation causes the HP-18C to display a message in lines 1 and 2, you can read portions of **Solver Calculations** on page 171 to explain the meaning of the message.
- **Case 2:** The HP-18C displays an answer in line 3 and automatically displays a message in lines 1 and 2. The solver has found a possible solution, but you must use judgement in interpreting the results. Refer to **Solver Calculations** on page 171 for more information.

- **Case 3:** The HP-18C displays TRY AGAIN. BAD GUESSES: and the guesses the solver used when the calculation was started (or restarted). This indicates that the solver cannot begin the search with the current guesses. Refer to **Entering Guesses**, below).
- **Case 4:** The HP-18C displays SOLUTION NOT FOUND because the solver was unable to find a solution. Check to see if your formula and stored values are correct. If the formula is correct, you may be able to find a solution by entering very good guesses.

## Halting and Restarting the Numerical Search

When the solver is searching for a numerical solution (in other words, when the solver is displaying sets of estimates), you can halt the calculation by pressing any key. The HP-18C displays the best estimate the solver has found so far, and the message INTERRUPTED. You can restart the search from where it left off by pressing the menu key for the variable you are solving for. Or, you can restart the search using your own guesses (refer to **Entering Guesses**, below).

## Entering Guesses

Entering your own guesses serves two purposes. First, it can save time by telling the solver where to start searching. Secondly, if more than one solution exists, entering guesses can help the solver select the answer you want. The closer your guesses are to the answer you want, the better chance the solver has of finding it.

You can enter guesses at these times:

- Before beginning the calculation, after you've stored a value for every variable except the unknown variable. If you enter one guess, the solver generates a second guess.
- After you've halted the numerical search.
- After the solver has returned an answer, and you wish to begin searching for another answer somewhere else.

You can enter one or two guesses. If you enter one guess, the solver makes a second guess. If you enter two guesses, the solver starts searching for a solution in the range between the two guesses. The solver works most efficiently when the answer is between your two guesses. For example, if you know the answer is between 5 and 12, you should enter 5 and 12 as the starting guesses.

To enter one guess, key in the value and press the menu key twice. For example, 4.5 [A] [A] enters 4.5 as a guess for a user-variable named A and starts the calculation.

To enter two guesses:

1. Key in the first guess and press the menu key.
2. Key in the second guess and press the menu key twice.

For example 0 [A] 100 [A] [A] causes the solver to search for A in the range 0 through 100.

**Example: Using guesses in a numerical solution.** One formula for calculating the profit from a manufacturing operation is:

$$\begin{aligned} \text{Profit} = & \text{ Price} \times \text{Quantity} - \text{Variable costs} \\ & \times \text{Quantity} - \text{Fixed Costs} \end{aligned}$$

The C-Sharp Piano Corporation sells pianos for \$6,000. Variable costs are \$4,100; fixed costs per year are \$112,000. How many pianos must C-Sharp sell this year in order to earn a profit of \$130,000? (In past years, C-Sharp has had to sell between 100 and 200 pianos to make an acceptable profit. You can use this information as initial guesses.)

Starting from the MAIN menu:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
SOLVE 	▶	Displays the SOLVE menu and bottom of the formula list.
PIANOS: PROFIT = PRICE  QUAN  VARCOST  QUAN  FIXED 		Enters the formula and displays the custom menu.
6000 PRICE	PRICE=6,000.00	Stores the price.
4100 VARCO		Stores the variable costs,
112000 FIXED		fixed costs, and profit.
130000 PROFIT	VARCOST=4,100.00 FIXED=112,000.00 PROFIT=130,000.00	
These steps are optional. They enter guesses for QUAN. If the solver must do a numerical search to solve for QUAN, it will begin the search using the estimates 100 and 200.		
100 QUAN	QUAN=100.00	Enters the first guess for QUAN.
200 QUAN	QUAN=200.00	Enters the second guess for QUAN.

```

QUAN    QUAN:200.000000000 - Solves for QUAN
          QUAN:100.000000000 + numerically.

.
.
.

QUAN=127.37

```

## Writing Formulas That the Solver Understands

Sometimes a formula printed in a book or written out longhand will have to be adapted before it can be typed into the formula list. For example, examine the following formula for calculating the annual yield on T-bills\*, printed as it might appear in a book:

$$\text{Annual yield} = \frac{\$10,000 - \text{price}}{\text{price}} \times \frac{360 \text{ days}}{\text{days to maturity}}$$

The formula requires several changes before the solver can understand it.

In discussing formulas, it helps to define several terms:

- *User-variables* are the named items—for example, Annual yield, price, and days to maturity.
- *Constants* are numbers—for example, \$10,000, 360 days.
- *Operators* perform arithmetic—for example,  $\times$ , and  $-$ .
- *Functions* do calculations involving one or two numbers—for example,  $\text{SQRT}(x)$ ,  $\text{USPV}(i\%:n)$ . Functions are described in the next section.

\* The price in this formula is in terms of full units of \$10,000.

In translating this formula into one that the solver can understand, there are several rules to keep in mind:

- There is no limit on the length of the formula as long as there is sufficient memory to store it.
- User-variable names can be a maximum of 10 characters long (no spaces allowed) and must be all one word. You cannot use the characters +, -, ×, ÷, ^, (, ), <, >, =, and :. For example, you could rewrite the T-bill formula as:

$$\text{YIELD} = \frac{\$10,000 - \text{PRICE}}{\text{PRICE}} \times \frac{360 \text{ days}}{\text{MATURITY}}$$

Shortened names, all uppercase letters

- The first four or five characters of the user-variable names become menu labels in the custom menu. Therefore, make sure no two variables have the same first four or five characters.
- Constants must be keyed in as numbers without digit separators or other characters. For example:

$$\text{YIELD} = \frac{10000 - \text{PRICE}}{\text{PRICE}} \times \frac{360}{\text{MATURITY}}$$

Numbers written properly

- Write the formula on one line. When necessary, use parentheses to control the order of calculations. Without parentheses, the solver does calculations using these algebraic rules:

**Exponentiation before multiplication and division.** For example, a formula typed in as  $A \times B^3 = C$  is interpreted as  $A \times B^3 = C$ . B is raised to the 3rd power and *then* multiplied by A. To raise  $A \times B$  to the 3rd power, write the formula:  $(A \times B)^3 = C$ .

**Multiplication and division before addition and subtraction.** For example, a formula typed in as  $A+B+C=12$  is interpreted as:

$$A + \frac{B}{C} = 12.$$

To divide the sum  $A + B$  by  $C$ , type the formula:  $(A+B)+C=12$ .

The T-bill formula can be written:

`YIELD=(10000-PRICE)/PRICE*360/MATURITY`

A good rule is: when in doubt, use parentheses. So, if you were unsure of how the T-bill formula written above would be interpreted, you could type it as:

`YIELD=((10000-PRICE)/PRICE)*(360/MATURITY)`

The extra parentheses don't change the meaning of the formula, but they may make it easier to understand.

- You cannot use parentheses for "implied" multiplication. For example, a formula printed in a book as  $P_{sn} = P_s(1-F)$  can be typed into the solver as `PSN=PS*(1-F)`. The `*` sign must be inserted between `PS` and the parenthesis.
- You can use spaces to make the formula more readable as long as there are no spaces inside variable names. The following version of the T-bill formula is easier to read:  
`YIELD = ((10000-PRICE) / PRICE) *  
(360 / MATURITY)`
- Formulas can use any of the functions listed in table 9-3 on page 144. Formulas can also include conditional expressions (covered on page 148).
- You cannot use logical operators (listed in table 9-4 on page 148) as variable names. For example, you cannot name a variable `AND`, but `CANDY` and `LAND` are acceptable variable names.

## SOLVER Functions

Table 9-3 lists the functions that can be included in formulas. Lower-case characters in parentheses stand for numbers, variable names, or numeric expressions.

**Table 9-3. Functions That Can Be Used in Formulas.**

Function	Description
ABS( $x$ )	Absolute value of $x$ .
ALOG( $x$ )	Common (base 10) antilogarithm; $10^x$
DATE( $d1:n$ )	The date $n$ days after (when $n$ is positive) or before (when $n$ is negative) date $d1$ . The format for $d1$ is set in the TIME/SET menu.
DDAYS( $d1:d2:c$ )	The number of days between dates $d1$ and $d2$ . The formats for $d1$ and $d2$ are set in the TIME menu; $c$ designates the calendar: <ul style="list-style-type: none"><li>■ <math>c = 1</math> for the actual calendar, which recognizes leap years.</li><li>■ <math>c = 2</math> for the 365-day calendar, which ignores leap years.</li><li>■ <math>c = 3</math> for the 360-day calendar, which uses 12, 30-day months.</li></ul>
EXP( $x$ )	Natural antilogarithm; $e^x$
EXPM1( $x$ )	$e^x - 1$
FACT( $x$ )	$x!$ ; factorial of a positive integer
FP( $x$ )	Fractional part of $x$ .
IDIV( $x:y$ )	Integer part of the quotient of $x / y$ .
INT( $x$ )	The greatest integer less than or equal to $x$ .
IP( $x$ )	Integer part of $x$ .
LN( $x$ )	Natural (base e) log of $x$ .
LNP1( $x$ )	$\ln(1 + x)$
LOG	Common (base 10) log of $x$ .

**Table 9-3. Functions That Can Be Used in Formulas.  
(Continued)**

Function	Description
MAX(x:y)	Compares $x$ and $y$ , and returns the larger of the two.
MIN(x:y)	Compares $x$ and $y$ , and returns the smaller of the two.
MOD(x:y)	The remainder of the division $x / y$ . $MOD(x,y) = x - y \times INT(x:y)$
PI	$\pi$ ; 3.14159265359 (12 digits).
RND(x:y)	Rounds $x$ to $y$ decimal places, returns the rounded value.
SGN(x)	Sign of $x$ (+1 if $x > 0$ , 0 if $x = 0$ , -1 if $x < 0$ ).
SPFV( $i\%:n$ )	Future value of a single \$1.00 payment; equivalent to $(1 + i\% \div 100)^n$ . $n$ is the number of compounding periods. $i\%$ is the interest rate per compounding period, expressed as a percentage.
SPPV( $i\%:n$ )	Present value of a single \$1.00 payment; equivalent to $1 \div SPFV(i\%:n)$ . $n$ is the number of compounding periods. $i\%$ is the interest rate per compounding period, expressed as a percentage.
SQRT(x)	Square root of $x$ .
TRN(x:y)	Truncates $x$ to $y$ decimal places, returns the truncated value.
USFV( $i\%:n$ )	Future value of a uniform series of \$1.00 payments; equivalent to $(SPFV(i\%:n) - 1) \div (i\% \div 100)$ . $n$ is the number of payments. $i\%$ is the periodic interest rate, expressed as a percentage.
USPV( $i\%:n$ )	Present value of a uniform series of \$1.00 payments; equivalent to $USFV(i\%:n) \div SPFV(i\%:n)$ . $n$ is the number of payments. $i\%$ is the periodic interest rate, expressed as a percentage.

**Example: Calculations for a loan with an odd first period.** An auto purchase is financed with a \$6,000 loan at 13.5% annual interest. There are 36 monthly payments to be made starting in one month and five days. What is the payment amount?

The following formula is used when the time period until the first payment is more than one month but less than two months. Interest for the odd period is calculated by multiplying the monthly interest by the number of days and dividing by 30.)

The formula for this loan situation is:

$$PV \left( 1 + \frac{\text{ANNI}}{1200} \times \frac{\text{DAYS}}{30} \right) + \text{PMT} \left( \frac{1 - \left( 1 + \frac{\text{ANNI}}{1200} \right)^{-N}}{\frac{\text{ANNI}}{1200}} \right) = 0$$

where:

ANNI = The annual percentage interest rate.

N = the number of payments.

DAYS = the number of odd days (an integer in the range 0 through 30).

PV = the amount of the loan.

PMT = the monthly payment.

The formula can be rearranged and typed into the solver as:

```
PV*(1+ANNI/1200*DAYS/30)  
+PMT*USPV(ANNI/12;N)=0
```

where USPV is the solver function for returning the present value of a uniform series of payments.

Starting from the MAIN menu:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
SOLVE		Displays the SOLVE menu and bottom of the formula list.
PV   1 ANNI  1200 DAYS  30 PMT USPV  ANNI 12:N  = 0 <b>CALC</b>		Enters the formula and displays the custom menu.
6000 <b>PV</b>	PV=6,000.00	Stores the loan amount.
13.5 <b>ANNI</b>	ANNI=13.50	Stores the annual percent interest.
5 <b>DAYS</b>		Stores the number of odd days.
36 <b>N</b>	N=36.00	Stores the number of payments..
<b>PMT</b>	PMT=-203.99	Calculates PMT.

## Conditional Expressions

Formulas can include conditional expressions using the function IF. For example, the solver accepts the formula:

BONUS=  
IF(SALES>3000:.02×SALES:.01×SALES)

The two colons inside the parentheses stand for "THEN" and "OR ELSE." According to this formula, if SALES are greater than 3000, then the BONUS equals  $.02 \times \text{SALES}$ ; otherwise, BONUS equals  $.01 \times \text{SALES}$ .

In general, the syntax of the IF function is:

IF(*conditional expression* : *algebraic expression* : *algebraic expression*)

The logical and relational operators that can be used in conditional expressions are described in table 9-4.

**Table 9-4. Operators Used in Conditional Expressions.**

Logical Operators	Relational Operators	
AND	> ( [Z])	Greater than.
OR	< ( [Y])	Less than.
EXOR	=	Equal to.
NOT	>=	Greater than or equal to.
	<=	Less than or equal to.
	<>	Not equal to.

Here are several additional examples of formulas using conditional expressions:

**Formula:**  $B = \text{IF} (7 < A \text{ AND } A \leq 15; 2 \times A \div 6; 3 \times A + 10) + C$

**Meaning:** If A is greater than 7 and less than or equal to 15, then  $B = 2 \times A \div 6 + C$ . Otherwise,  $B = 3 \times A + 10 + C$ .

**Formula:**  $\text{VALUE} = \text{FIRST} + \text{IF}(\text{NOT FIRST}=0; 1 \div \text{FIRST}; 0)$

**Meaning:** If FIRST is unequal to 0, then  $\text{VALUE} = \text{FIRST} + 1 \div \text{FIRST}$ . If  $\text{FIRST} = 0$ , then  $\text{VALUE} = \text{FIRST}$ .

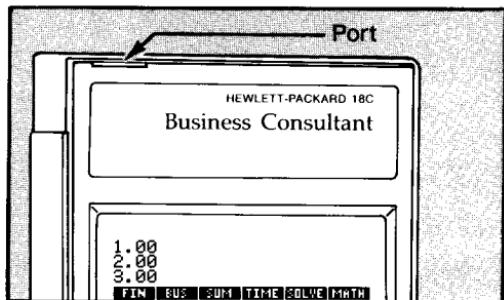
# 10

## Printing

### Introduction

The HP-18C can create a printed copy of most of its operations and stored information using the printer designed to accept the infra-red signal generated by the printer port. This chapter describes the types of printing the HP-18C can do. Operation of the printer is covered in the printer owner's documentation.

**Figure 10-1. The printer port.**



The HP-18C automatically sends out information at a rate required by the printer. If a printing operation involves printing many lines of information, the calculator automatically slows its transmission of information to allow the printer to catch up.

---

## Printing Modes

The HP-18C has two printing modes—*manual* and *trace*. Manual mode is used when you don't want anything printed, or when you want to specify exactly what will be printed. In manual mode, you can choose to print:

- The contents of the calculator line.
- A descriptive note or label.
- The values stored in registers 0, 1, 2, and 3.
- A copy of the first three lines of the display.
- The current date and time.
- Values of built-in variables stored and calculated using menus.
- Values of user-variables stored and calculated using custom menus.
- A number list.
- An amortization table.

Trace mode is used when you want a complete record of the numbers you've keyed in, the calculated results, and the other keys you've pressed.

To switch between trace mode and manual mode:

1. Press **[PRINTER]**.
2. Press **TRACE**. A display message informs you that tracing is on or off.
3. Press **EXIT**.

---

## The Print Annunciator

The print annunciator () is on when the HP-18C is sending information out through the infra-red printer port. The calculator has no way of knowing whether the printer is receiving the infra-red signal.

## Trace Mode

Trace mode produces a printed record of your interaction with the calculator.

**Example: Tracing an arithmetic calculation.** Produce a record of the keystrokes you use to do the following calculation and store the result in the TVM built-in variable PMT.

$$1/12 \times 4,800 + 125$$

Starting from the MAIN menu, in manual mode:

**Keys:**

[ PRINTER] TRACE

[EXIT]

[FIN]

[TVM]

12 [ 1/x]

[x]

4800 [+]

125 [=]

[PMT]

[ PRINTER]

[TRACE]

[EXIT]

**Printed Record:**

EXIT

FIN

TVM

12.00      1/x  
0.08      \*\*\*

x

4,800.00      +

125.00      =  
525.00      \*\*\*

PMT

PRINTER

TRACE

## Manual Print Mode

Use manual print mode when you want to print selected information:

- Press **[PRNT]** to print the rightmost number in the calculator line. If the calculator is in alpha mode, the entire contents of line 3 is printed. When The HP-18C is displaying the SOLVE menu, pressing **[PRNT]** prints the current formula.
- Press **[PRINTER]** to display the PRINTER menu. You can use the PRINTER menu to print a variety of information (refer to table 10-1). The PRINTER menu is also used to switch between trace and manual modes.

**Table 10-1. The PRINTER Menu.**

Menu Key	Description
<b>DISPL</b>	Prints a copy of the first three lines of the display.
<b>LIST</b>	Prints values stored and/or calculated using the HP-18C menus.
<b>REGS</b>	Prints the contents of registers 0, 1, 2, and 3.
<b>TIME</b>	Prints the current time and date.
<b>TRACE</b>	Switches between trace and manual print modes.

## Printing Values Stored and Calculated Using Menus

The values printed by the **[LIST]** key depend on which menu the HP-18C is currently displaying. Table 10-2 describes how to print various values. For example, to print the values stored in OLD, NEW, and %CH, display the %CHG menu, and then press **[PRINTER] [LIST]**.

**Table 10-2. Printing menu values.**

To Print:	Display This Menu and Press <input type="checkbox"/> PRINTER <input type="checkbox"/> LIST
<b>General Business</b>	
OLD, NEW, %CH	%CHG
TOTAL, PART, %T	%TOTL
COST, PRICE, M%C	MU%C
COST, PRICE, M%P	MU%P
<b>Time Value of Money</b>	
N, I%YR, PV, PMT, FV, #PMTS/YR, TVM	
BEGIN/END mode	
<b>Interest Conversions</b>	
NOM%, EFF%, P	EFFCT
NOM%, EFF%	CONT
<b>Cash Flows</b>	
CFLO number list	CFLO
TOTAL, I%, NPV, NUS, NFV	CALC menu in CFLO
<b>Running Total and Statistics</b>	
SUM number list	SUM
TOTAL, MEAN, MEDIAN, STDEV, RANGE, MIN, MAX	CALC menu in SUM
XLIST, YLIST, CORR, A, B	LIN, LOG, EXP and PWR menus (in FRCST)
<b>Appointments</b>	
List of appointments	APPT, APPT1—APPT6, RPT
<b>Date Arithmetic</b>	
DATE1, DATE2, ACTUAL DAYS, 360 DAYS, 365 DAYS	CALC menu in TIME
<b>The Formula Solver</b>	
Current formula and the values of all the user-variables in a formula.*	The custom menu for that formula.
The entire formula list	SOLVE

\* To print the current formula, display the SOLVE menu and press  PRNT.

## **Printing Descriptive Notes**

You may want to include a descriptive note in your printed information. For example, if you are about to print a number on the calculator line, you may want to label the number. To print a descriptive phrase, type in the characters and press **PRNT**. For example, typing **SEPTEMBER BALANCE** **PRNT** prints **SEPTEMBER BALANCE** on a line by itself.

## **Printing an Amortization Table**

To print an amortization table:

1. Enter the loan information, using steps 1 through 8 on page 67.
2. Press **AMRT**.
3. If you wish to start the table anywhere other than at payment #1, amortize all the previous payments using step 10 on page 67.
4. Key in the number of payments per table entry and press **#P**.
5. Press **TABLE**.
6. Key in the last payment to be printed and press **START**.

To halt printing before the table is completed, press any key.

**Example: Printing an amortization table.** To purchase your new home, you have taken out a 30-year, \$65,000 mortgage at 12.5% annual interest. Your monthly payment is \$693.72. Print an amortization table with entries for the fifth and sixth years.

Starting from the MAIN menu:

<b>Keys:</b>	<b>Display:</b>	<b>Description:</b>
<b>FIN TVM</b>		Displays the TVM menu.
<b>CLEAR ALL</b>	<b>0.00</b>	Clears the history stack and the TVM variables.
<b>12.5 I%YR</b>	<b>I%YR=12.50</b>	Stores the annual interest.
<b>65000 PV</b>	<b>PV=65,000.00</b>	Stores the amount of the loan.
<b>693.72 +/-</b>		Stores the monthly payment.
<b>PMT</b>	<b>PMT=-693.72</b>	
<b>OTHER</b>		Displays the secondary TVM menu.
<b>CLEAR ALL</b>	<b>12 PMTS/YR: END MODE</b>	Sets 12 payments per year, End mode.
<b>AMRT</b>		Displays the AMRT menu.
<b>48 #P</b>	<b>PAYMENTS: 1-48 BALANCE=63,970.71 INTEREST= -32,269.27</b>	Calculates the amortization schedule for the first 4 years.

12 **\*P**

PAYMENTS: 49-60  
BALANCE=63,622.94  
INTEREST=-7,976.87

Calculates the amortization schedule for the fourth year.

**TABLE** 72

**START**

Prints the amortization table with two entries for payments 49-60 and 61-72.

**Figure 10-2. An amortization table.**

```
I%YR=          12.50
PV=           65,000.00
PMT=          -693.72
#PMTS/YR=    12.00
END MODE

PAYMENTS:49 - 60
INTEREST=      -7,976.87
PRINCIPAL=     -347.77
BALANCE=       63,622.94

PAYMENTS:61 - 72
INTEREST=      -7,930.82
PRINCIPAL=     -393.82
BALANCE=       63,229.12
```

# A

## **Customer Support, Warranty, and Service**

### **Obtaining Help in Operating the Calculator**

We at Hewlett-Packard are committed to providing the owners of HP calculators with ongoing support. You can obtain answers to your questions about using the calculator from our Calculator Technical Support department.

We suggest that you read the next section, **Answers to Common Questions**, before contacting us. Past experience has shown that many of our customers have similar questions about our products.

If you don't find an answer to your question, you can contact us using the address or phone number listed on the inside back cover.

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### **Answers to Common Questions**

**Question:** I'm not sure if the calculator is malfunctioning or if I'm doing something incorrectly. How can I determine if the calculator is operating properly?

**Answer:** Refer to page 164, which describes the diagnostic self-test.

**Question:** How do I change the number of decimal places the HP-18C displays?

**Answer:** The procedure is described in **Changing the Number of Displayed Decimal Places** on page 43.

**Question:** How do I clear all or portions of memory?

**Answer:**  $\boxed{\text{CLEAR}}$  clears the calculator line.  $\boxed{\text{CLEAR ALL}}$  clears various portions of memory, depending on which menu the HP-18C is displaying. (Look up **CLEAR ALL** in the subject index for a list of page references.) Erasing the entire contents of memory is covered in **Erasing Continuous Memory** on page 188.

**Question:** Why am I getting the wrong answer using the TVM menu?

**Answer:** Before beginning a TVM calculation, be sure to clear the TVM variables ( $\boxed{\text{CLEAR ALL}}$ ) set the appropriate payment mode (mortgages and loans are typically End mode calculations), and specify the number of payments per year  $\boxed{\text{P/Y}}$

**Question:** How do I indicate multiplication in a formula typed into the solver?

**Answer:** You must use the multiplication sign ( $\times$ ) on the right side of the keyboard. You *cannot* use the  $\boxed{\text{X}}$  letter key to indicate multiplication.

**Question:** How do I type a comma in alpha mode?

**Answer:** Press  $\boxed{\text{#}}$ .

**Question:** My numbers contain commas instead of periods as decimal points. How do I restore the periods?

**Answer:** Changing the decimal point is covered in **Interchanging the Period and Comma in Numbers** on page 44.

**Question:** What does an “E” in a number (for example, 2.51E–13) mean?

**Answer:** The number is very large or very small. Refer to **Scientific Notation** on page 44.

**Question:** The calculator has displayed the message **INSUFFICIENT MEMORY**. What should I do?

**Answer:** Refer to **Managing Calculator Memory** on page 189 for instructions on how to reclaim memory for your use.

**Question:** The calculator is operating more slowly than usual, and the  annunciator is blinking. Why?

**Answer:** The calculator is in trace mode for printing. Press **[ ] PRINTER [ ] TRACE [ ] EXIT** to turn off tracing.

**Question:** How can I change the sign of a number in a list without keying in the number again?

**Answer:** Position the list pointer at the number and press **[ ] RCL [ ] INPUT [+/-] [ ] INPUT**.

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## Limited One-Year Warranty

The HP-18C (except for the batteries, or damage caused by the batteries) is warranted by Hewlett-Packard against defects in materials and workmanship for one year from the date of original purchase. If you sell your unit or give it as a gift, the warranty is automatically transferred to the new owner and remains in effect for the original one-year period. During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective, provided you return the product, shipping prepaid, to a Hewlett-Packard service center.

## What We Will Do

*Batteries, and damage caused by the batteries, are not covered by the Hewlett-Packard warranty. Check with the battery manufacturer about battery and battery leakage warranties.*

This warranty does not apply if the product has been damaged by accident or misuse or as the result of service or modification by other than an authorized Hewlett-Packard service center.

## **What Is Not Covered**

No other express warranty is given. The repair or replacement of a product is your exclusive remedy. **ANY OTHER IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS IS LIMITED TO THE ONE-YEAR DURATION OF THIS WRITTEN WARRANTY.** Some states, provinces, or countries do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you. **IN NO EVENT SHALL HEWLETT-PACKARD COMPANY BE LIABLE FOR CONSEQUENTIAL DAMAGES.** Some states, provinces, or countries do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

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

## **Warranty for Consumer Transactions in the United Kingdom**

This warranty shall not apply to consumer transactions and shall not affect the statutory rights of a consumer. In relation to such transactions, the rights and obligations of Seller and Buyer shall be determined by statute.

## **Obligation to Make Changes**

Products are sold on the basis of specifications applicable at the time of manufacture. Hewlett-Packard shall have no obligation to modify or update products once sold.

## **Warranty Information**

If you have any questions concerning this warranty, please contact an authorized Hewlett-Packard dealer or a Hewlett-Packard sales and service office. Should you be unable to contact them, please contact:

- In the United States: The Calculator Service Center. The address and phone number are listed on the inside back cover.
- In Europe:

Hewlett-Packard S.A.  
150, route du Nant-d'Avril  
P.O. Box CH-1217 Meyrin 2  
Geneva, Switzerland  
Telephone: (022) 82 81 11

Note: Do not send calculators to this address for repair.

- In other countries:

Hewlett-Packard International  
3495 Deer Creek Rd.  
Palo Alto, California 94304  
U.S.A.  
Telephone: (415) 857-1501

Note: Do *not* send calculators to this address for repair.

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## **Determining If the Calculator Requires Service**

Use these guidelines to determine if the calculator requires service. If these procedures confirm that the calculator is not functioning properly, read the section **If the Calculator Requires Service** starting on page 165.

- **If the calculator won't turn on (nothing is visible in the display),** replace the batteries. The instructions for replacing batteries start on page 185. If replacing the batteries doesn't restore the display, the calculator requires service.

■ **If the calculator doesn't respond to keystrokes (nothing happens when you press any of the keys):**

1. Attempt to reset the calculator by holding down the **[ON]** key while you press the third menu key from the left. Page 187 contains additional information about resetting the calculator.
2. If the calculator fails to respond after step #1, attempt to erase Continuous Memory. This will erase all the information you've stored in the HP-18C. To erase Continuous Memory, hold down these three keys at the same time—the **[ON]** key, the leftmost menu key, and the rightmost menu key. Page 188 contains additional information about erasing Continuous Memory.
3. If steps 1 and 2 fail to restore calculator function, the calculator requires service.

■ **If the calculator responds to keystrokes but you suspect that it is malfunctioning:**

1. Do the self-test (described below). If the calculator fails the self test, it requires service.
2. If the calculator passes the self-test, it is quite likely that you've made a mistake in operating the calculator. Try rereading the portion of the manual that describes the type of calculation you are doing, and check the section **Answers to Common Questions** on page 159.
3. If you cannot find the answer to your question in the manual, you can communicate with an expert on calculator operation by contacting the Calculator Technical Support department. The address and phone number are listed on the inside back cover.

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## **Confirming Calculator Operation—the Self-Test**

If the display can be turned on, but it appears that the calculator is not operating properly, you can do a diagnostic self-test. To run the self-test:

1. Turn the calculator on.

- 2.** If you have the optional printer, turn it on. Certain diagnostic information will be printed as the test proceeds.
- 3.** If possible, return to the **MAIN** menu by pressing **■ [MAIN]**.
- 4.** To start the self-test, hold down the **ON** key while you press the fifth menu key from the left\*. Once the self-test has begun, do not press any keys until you are ready to halt the test. The HP-18C displays a series of patterns. You should watch for one of two messages. They are displayed briefly, before the test automatically repeats.
  - If the calculator passes the self-test, the HP-18C displays **OK-18C-E**.
  - If the HP-18C displays a number followed by **FAIL**, the calculator may require service.
- 5.** To halt the self-test, hold down the **ON** key while you press the third menu key from the left. The HP-18C displays **MACHINE RESET**. If you press any other key instead, the test halts and the HP-18C displays a **FAIL** message. *This message results from an incorrect key being pressed, and does not mean that the calculator requires service.*
- 6.** If the HP-18C failed the self-test, you should repeat steps 4 and 5 to verify the results.

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## If the Calculator Requires Service

Hewlett-Packard maintains service centers in most major countries throughout the world. You may have your calculator serviced at a Hewlett-Packard service center any time it malfunctions, whether the unit is under warranty or not. There is a charge for service after the one-year warranty period. Calculators normally are serviced and re-shipped within five (5) working days of receipt at any service center. This is an average time and could possibly vary depending upon the time of year and work load at the service center. The total time you are without your calculator will depend largely on the shipping time.

\* Pressing the fourth menu key from the left starts another self-test that is used at the factory. If you accidentally start this self-test, you can stop it by holding down the **ON** key while you press the third menu key from the left.

## **Obtaining Service in the United States**

The address and phone number of the Calculator Service Center are listed on the inside back cover.

## **Obtaining Service in Europe**

Contact one of the following Hewlett-Packard entities for the location of the service center nearest you. (Do *not* ship your calculator to a service center without first contacting one of these entities.)

### **Austria**

Hewlett-Packard GmbH  
Kleinrechner-Service  
Wagramerstr. Liebigasse  
A-1220 Vienna  
Telephone: (222) 23 65 11

### **Belgium**

Hewlett-Packard Belgium SA/NV  
Boulevard de la Woluwe 100  
Woluwelaan  
B-1200 Brussels  
Telephone: (2) 762 32 00

### **Denmark**

Hewlett-Packard A/S  
Datavej 52  
DK-3460 Birkeroed (Copenhagen)  
Telephone: (02) 81 66 40

### **Eastern Europe**

Refer to the address listed under Austria

### **Finland**

Hewlett-Packard OY  
Revontulentie 7  
SF-02100 Espoo 10 (Helsinki)  
Telephone: (90) 455 02 11

### **France**

Hewlett-Packard France  
Division Informatique Personnelle  
S.A.V. Calculateurs de Poche  
F-9147 Les Ulis Cedex  
Telephone: (6) 907 78 25

### **Germany**

Hewlett-Packard GmbH  
Kleinrechner-Service  
Vertriebszentrale  
Berner Strasse 117  
Postfach 560 140  
D-6000 Frankfurt 56  
Telephone: (611) 50041

### **Italy**

Hewlett-Packard Italiana S.P.A.  
Casella postale 3645 (Milano)  
Via G. Di Vittorio, 9  
I-20063 Cernusco Sul Naviglio (Milan)  
Telephone: (2) 90 36 91

### **Netherlands**

Hewlett-Packard B.V.  
Van Heuven Goedhartlaan 121  
N-1181 KK Amstelveen (Amsterdam)  
P.O. Box 667  
Telephone: (020) 472021

### **Norway**

Hewlett-Packard Norge A/S  
P.O. Box 34  
Oesterndalen 18  
N-1345 Oesteraas (Oslo)  
Telephone: (2) 17 11 80

### **Spain**

Hewlett-Packard Espanola S.A.  
Calle Jerez 3  
E-Madrid 16  
Telephone: (1) 458 2600

### **Sweden**

Hewlett-Packard Sverige AB  
Enighetsvagen 3  
Box 205 02  
S 161 Bromma 20 (Stockholm)  
Telephone: (8) 730 05 50

### **Switzerland**

Hewlett-Packard (Schweiz) AG  
Kleinrechner-Service  
Allmend 2  
CH-8967 Widen  
Telephone: (057) 50111

### **United Kingdom**

Hewlett-Packard Ltd  
King Street Lane  
GB-Winnersh, Wokingham  
Berkshire RG11 5AR  
Telephone: (0734) 784 774

## **International Service Information**

Not all Hewlett-Packard service centers offer service for all models of HP calculators. However, if you bought your calculator from an authorized HP dealer, you can be sure that service is available in the country where you bought it.

If you are outside the country where you bought your calculator, you can contact one of the entities listed on the previous page, or the local HP service center, to see if service is available for it. If service is unavailable, please ship the unit to the United States Calculator Service Center. The address is listed on the inside back cover. A list of service centers for other countries can be obtained by writing to that address.

All shipping, reimportation arrangements, and customs costs are your responsibility.

## **Shipping Instructions**

If your calculator requires service, ship it to the nearest Hewlett-Packard service center or designated collection point. Along with the calculator, you should include:

- Your return address and description of the problem. If a Service Card was included in the box with your calculator, you can use it to provide the service center with this information.
- If the one-year warranty has not expired, include a sales receipt or other documentary proof of purchase date.

The calculator and accompanying information should be packaged in the original shipping box or other adequate protective packaging to prevent in-transit damage. Such damage is not covered by the one-year limited warranty; Hewlett-Packard suggests that you insure the shipment to the service center. If necessary, contact your dealer for assistance.

Whether or not the unit is under warranty, it is your responsibility to pay shipping charges for delivery to the Hewlett-Packard service center. If the unit is under warranty, the serviced calculator is returned to you with postage prepaid. For out-of-warranty service in the United States and some countries, the unit is returned C.O.D. (covering shipping costs and the service charge).

## **Service Agreements**

A service support agreement is available for your product. Refer to the literature included in the box. For additional information, please contact the Calculator Service Center; the address and phone number are listed on the inside back cover.

## **Service Charge**

There is a standard charge for out-of-warranty service that includes labor and materials. In the United States, the full charge is subject to the customer's local sales tax. In European countries, the full charge is subject to Value Added Tax (VAT) and similar taxes wherever applicable. All such taxes will appear as separate items on invoiced amounts.

Calculator products damaged by accident or misuse are not covered by the fixed service charges. In these situations, service charges will be individually determined based on time and material.

## **Warranty on Service**

Any out-of-warranty service is warranted against defects in materials and workmanship for a period of 90 days from the date of service.

## More About HP-18C Calculations

### IRR% Calculations

The HP-18C calculates IRR% for a set of cash flows using mathematical formulas that "search" for the answer. The process finds a solution by estimating an answer and then using that estimate to do another calculation—in mathematical terms, an iterative process.

In most cases, the HP-18C finds the correct answer, since there is usually only one solution to the calculation. However, calculating IRR% for certain sets of cash flows is more complex. There may be more than one mathematical solution to the problem, or there may be no solution. In these cases, the HP-18C displays a message to help you interpret what has happened.

### Possible Outcomes of Calculating IRR%

These are the possible outcomes of an IRR% calculation for which you have not stored a guess. Storing a guess is covered on page 170.

- **Case 1:** The HP-18C displays a positive answer. This is the only positive answer. However, one or more negative answers may exist.
- **Case 2:** The HP-18C displays a negative answer and the message:  
`IRR%>0 EXISTS; TO SEEK:  
INPUT GUESS [STO]K(IRR%)`

The HP-18C has detected that there is a single positive answer. To search for that positive answer, you must input a guess. (Refer to **Storing a Guess for IRR%** on page 170). There may also be one or more additional negative answers.

- **Case 3:** The HP-18C displays a negative answer and no message. This is the only answer.

- **Case 4:** The HP-18C displays the message:

MANY OR NO SOLUTIONS;  
INPUT GUESS [STO] (IRR%)

The calculation is very complex. It may involve more than one positive and/or negative answer or there may be no solution. To continue the calculation, you must store a guess.

- **Case 5:** There is no answer. The HP-18C displays:

NO SOLUTION

This situation may have been caused by a mistake made in keying in the cash flows. Review the number list for typing mistakes or incorrect signs. One thing to look for is a mistake in entering the sign of a cash flow. There can be no solution without at least one positive *and* one negative cash flow.

## Halting and Restarting the IRR% Calculation

The search for IRR% may take a relatively long time. You can halt the calculation at any time by pressing any key. The HP-18C then displays the current estimate for IRR%. You can resume the calculation by:

- Pressing [STO] [IRR%] while the current estimate is displayed in the calculator line. This continues the calculation from where it left off.
- Storing a guess for IRR%, discussed below.

## Storing a Guess for IRR%

You can enter a guess for IRR% at these times:

- Before beginning the IRR% calculation. If you have some idea what the answer should be, this may reduce the time required to calculate an answer.
- After you've halted the IRR% calculation.
- After the HP-18C has halted the calculation due to any of the cases listed above. For cases 3 and 5, however, no (other) solutions will be found.

To enter a guess:

1. Key in an estimate of IRR%.
2. Press **STO** **IRR%**.

When it is calculating IRR% using a guess you've entered, the HP-18C displays the current estimate of IRR% and the calculated value of NPV for each iteration. The calculation halts when the HP-18C finds an answer near your guess. However, there may be additional positive or negative answers or there may be no solution. You can continue searching for other solutions by halting the calculation and entering a different guess.

One way to obtain a good guess for IRR% is to calculate NPV for various interest rates (I%). Since IRR% is the interest rate at which NPV equals 0, the best estimate of IRR% is the interest rate that yields the value for NPV closest to 0.

To find a good estimate for IRR%, key in a guess for IRR% and press **I%**. Then, press **NPV** to calculate NPV for that value. Repeat the calculation of NPV for several values of I%, and look for trends in the results. Choose as your guess for IRR% the value of I% that produces an NPV closest to 0.

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## Solver Calculations

In most cases, the solver calculates and displays the answer to your problem, because there is only one correct answer and the formula is easy for the solver to interpret. However, the solver is capable of handling a wide variety of complex mathematical conditions. In order for you to use all the calculating power included in the solver, it will be helpful to you to understand, in a general way, how it works.

## Direct Solutions

When you start a calculation (by pressing a menu key), the solver first tries to find a *direct* solution by “isolating” the user-variable you are solving for (frequently called the “unknown”). Isolating a variable involves rearranging the formula so that the unknown variable is by itself on the left-hand side of the formula. For example, if you enter the formula:

**PROFIT = PRICE-COST**

and solve for COST (COST is the unknown), the solver uses rules of algebra to internally rearrange the formula to:

**COST = PRICE – PROFIT**

After you’ve stored values for PROFIT and PRICE, pressing **COST** causes the solver to use the rearranged formula to calculate an answer. Answers calculated this way are called direct solutions.

For certain formulas, the unknown can be isolated, but an answer cannot be calculated with the values you store. Then, the HP-18C displays:

**SOLUTION NOT FOUND**

For example, if you enter a formula:

**AREA = L×W**

and then enter values for AREA and W, the solver rearranges the formula to:

**L = AREA ÷ W**

in order to calculate L. However, if you enter the value 0 for W, the solver cannot find an answer because division by zero is not allowed.

The solver can isolate the unknown variable if the formula meets these conditions:

- The unknown variable occurs only once in the formula.

- The only functions in which the unknown variable appears are ALOG, EXP, EXPM1, LN, LNP1, LOG, and SQRT.
- The only operators involving the unknown variable are  $+$ ,  $-$ ,  $\times$ ,  $\div$ , and  $^$ . If you are solving for a variable raised to a positive, even power (for example,  $A^2 = 4$ ), there may be more than one solution. However, if the solver can isolate the variable, it will find *one* of the solutions using the positive root. For example, the solver rearranges  $A^2=4$  to  $A = \sqrt{4}$  and calculates the answer  $+2$ .\*
- The unknown variable does not appear as an exponent.

## Numerical Solutions

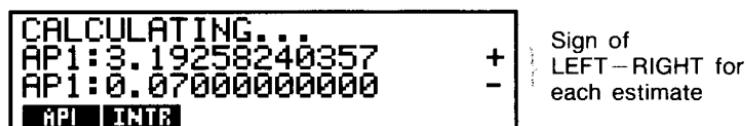
If the solver is not able to isolate the unknown variable, it cannot provide a direct solution. In these cases, the solver searches for a numerical solution.†

In its search for a numerical solution, the solver is looking for a value that sets the left-hand side of the formula equal to the right-hand side. To do this, the solver first uses two initial estimates of the answer, which we'll call estimate #1 and estimate #2. Using estimate #1, the solver calculates values for the left and right side of the formula (LEFT and RIGHT) and calculates LEFT minus RIGHT ( $LEFT - RIGHT$ ). Then, the solver does the same calculations for estimate #2. If neither estimate produces a value of 0 for  $LEFT - RIGHT$ , the solver analyzes the results of its calculations and produces two new estimates that it judges to be closer to the answer. By repeating this process many times, the solver narrows in on the answer. During the search for a numerical solution, the HP-18C displays the two current estimates and the sign of  $LEFT - RIGHT$  for each estimate (see figure B-1).

\* A formula can be rewritten to cause the solver to find the negative root. For example, if  $A^2=4$  is rewritten as  $(-A)^2=4$ , the solver rearranges the formula to  $A = -\sqrt{4}$  and calculates the solution  $-2$ .

† The solver's ability to find a numerical solution can often be enhanced by rewriting the formula so that the unknown variable does not appear as a divisor. For example, the solver may more easily solve for  $A$  if the formula  $1/(A^2-A)=B$  is rewritten as  $(A^2-A)\times B=1$ .

**Figure B-1. Displaying the Current Estimates During a Numerical Calculation.**



Since calculators cannot do calculations with infinite precision (the HP-18C uses 12 digits in its calculations), sometimes the solver will be unable to find an estimate where LEFT—RIGHT is exactly 0. However, the solver can distinguish between situations where the current estimate *may* be a solution, and situations where the solver cannot find a solution.

The search for a numerical solution can sometimes take several minutes. (You can halt the search at any time by pressing any key.) There are four possible outcomes for a numerical solution:

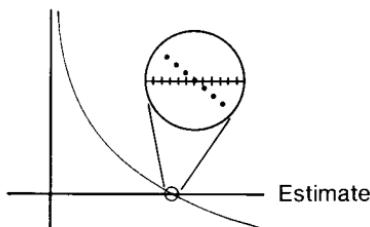
- **Case 1:** The HP-18C displays an answer on line 3 and there is no message in lines 1 and 2. It is very likely that the answer on line 3 is a solution for the unknown variable.

There are two situations in which the solver returns a case 1 answer (see figure B-2):

- Case 1a: LEFT—RIGHT is exactly 0.
- Case 1b: LEFT—RIGHT is not zero for either estimate. However, the solver has found two estimates that cannot get any closer together. (Numbers that are as close together as possible are called “neighbors.”) Furthermore, LEFT—RIGHT is a positive value for one estimate and a negative value for the other estimate.

## Figure B-2. Numerical Solutions—Case 1

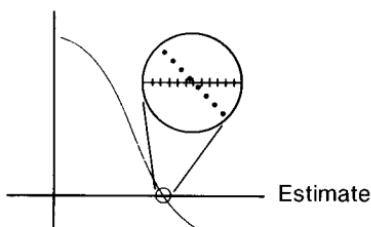
LEFT – RIGHT



Case 1a:

LEFT – RIGHT is exactly 0.

LEFT – RIGHT



Case 1b:

LEFT – RIGHT is not exactly 0.  
LEFT and RIGHT are relatively close together. The two estimates are "neighbors".

If you want to know whether LEFT – RIGHT is *exactly* 0, press the menu key for the unknown variable. If LEFT – RIGHT is *not* equal to 0, the HP-18C displays the values of LEFT and RIGHT on lines 1 and 2.

## Figure B-3. Displaying LEFT and RIGHT For a Numerical Solution

```
LEFT : 79.9999999999  
RIGHT: 80.0000000000  
AP1=9.46
```

AP1 INTR

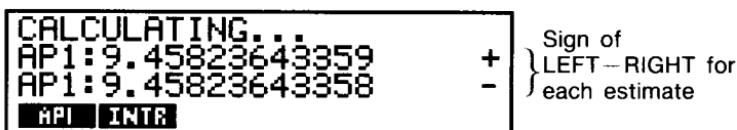
The formula could have more than one numerical solution. If the answer does not seem reasonable, you should enter one or two guesses and restart the search.

- **Case 2:** The HP-18C displays an answer on line 3 and automatically displays the values of LEFT and RIGHT on lines 1 and 2. The answer on line 3 *could be* a solution for the variable. If LEFT and RIGHT are relatively close to one another in value, the answer is probably a solution. Otherwise, the answer is probably not a solution.

If the answer in line 3 seems unreasonable, it could be because the formula has more than one numerical solution. You might want to enter one or two guesses and restart the search.

If you want to obtain additional information about the answer, press and hold down the menu key for the unknown variable until the numbers in the display stop changing. At this point, the solver is displaying the final estimates and the signs of LEFT—RIGHT for each estimate.

**Figure B-4. Displaying the Final Estimates and Signs of LEFT—RIGHT**

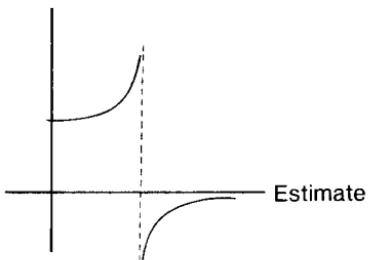


This information can be helpful (see figure B-5):

- Case 2a: If the signs of LEFT—RIGHT are opposite, and the two estimates are as close together as two 12-digit numbers can get (neighbors), the solver found two estimates that “bracketed” an ideal solution (a solution where LEFT—RIGHT equals 0). If LEFT and RIGHT are relatively close together, the answer is probably a solution. Otherwise, the answer is probably not a solution.
- Case 2b: If the signs of LEFT—RIGHT are opposite, and the two estimates are not neighbors, you should be very cautious about accepting the answer as a solution. If LEFT and RIGHT are relatively close together, the answer is probably a solution.
- Case 2c: If LEFT—RIGHT for the two estimates have the same sign, the solver has halted because it could find no estimates that further reduced the magnitude of LEFT—RIGHT. You should be very cautious about accepting the answer. If the values of LEFT and RIGHT are not relatively close to one another, you should reject the answer as a solution.

**Figure B-5: Numerical Solutions—Case 2**

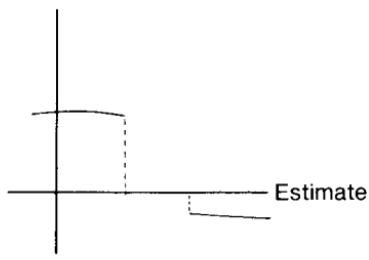
LEFT—RIGHT



Case 2a:

LEFT—RIGHT have opposite signs. The two estimates are "neighbors".

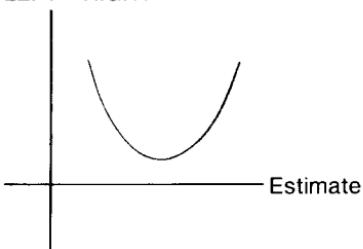
LEFT—RIGHT



Case 2b:

LEFT—RIGHT have opposite signs. The two estimates are far apart.

LEFT—RIGHT



Case 2c:

LEFT—RIGHT have the same sign.

■ **Case 3:** The HP-18C displays:

TRY AGAIN. BAD GUESSES:

This indicates that the solver is unable to begin its search for a numerical solution using the current initial estimates (guesses). There may be a solution you can find by entering different estimates. The closer you can estimate the answer, the more likely it is that the solver will find a solution.

- **Case 4:** The HP-18C displays:

SOLUTION NOT FOUND

This message indicates that the solver is unable to make any progress towards finding a solution. You should check your formula to make sure you have made no errors in entering it. Also check the values of each of the known variables. If your formula and variables are correct, you *may* be able to find a solution by entering very good guesses.

---

## Formulas Used by HP-18C Menus

The following formulas are used to calculate values using the HP-18C menus and built-in variables. Variables that appear on menu key labels are not defined here (for example, %CHANGE, PMT, I%YR). Refer to the section of the manual that covers each menu for definitions of those variables.

### Actuarial Functions

The actuarial formulas describe the four actuarial functions included in the formula solver. These formulas are also used to simplify the time value of money and cash flow formulas, below.

$n$  = number of compounding periods.

$i\%$  = periodic interest rate, expressed as a percentage.

Single Payment Present Value Function  
(Present value of a single \$1.00 payment)

$$\text{SPPV } (i\%:n) = \left(1 + \frac{i\%}{100}\right)^{-n}$$

Single Payment Future Value Function  
(Future value of a single \$1.00 payment after  $n$  periods.)

$$\text{SPFV } (i\%:n) = \left(1 + \frac{i\%}{100}\right)^n$$

Uniform Series Present Value Function  
(Present value of a \$1.00 annuity)

$$\text{USPV } (i\%:n) = \frac{1 - \left(1 + \frac{i\%}{100}\right)^{-n}}{\frac{i\%}{100}}$$

Uniform Series Future Value Function  
(Future value of a \$1.00 annuity after  $n$  periods)

$$\text{USFV } (i\%:n) = \frac{\left(1 + \frac{i\%}{100}\right)^n - 1}{\frac{i\%}{100}}$$

## General Business (BUS)

$$\% \text{CHANGE} = \left( \frac{\text{NEW} - \text{OLD}}{\text{OLD}} \right) \times 100$$

$$\% \text{TOTAL} = \left( \frac{\text{PART}}{\text{TOTAL}} \right) \times 100$$

$$\text{MARKUP\%C} = \left( \frac{\text{PRICE} - \text{COST}}{\text{COST}} \right) \times 100$$

$$\text{MARKUP\%P} = \left( \frac{\text{PRICE} - \text{COST}}{\text{PRICE}} \right) \times 100$$

## Time Value of Money (TVM)

$S$  = payment mode factor (0 for End mode; 1 for Begin mode).

$$i\% = \frac{I\%YR}{\#P/Y}$$

$$0 = PV + \left(1 + \frac{i\% \times S}{100}\right) \times PMT \times USPV(i\%:n) + FV \times SPPV(i\%:n)$$

## Amortization

$\Sigma INT$  = accumulated interest

$\Sigma PRIN$  = accumulated principal

$i$  = periodic interest rate

$BAL$  is initially the TVM value of  $PV$ , rounded to the current display setting.

$PMT$  is initially the TVM value of  $PMT$ , rounded to the current display setting.

$$i = \frac{I\%YR}{\#P/Y \times 100}$$

For each payment amortized:

$INT' = BAL \times i$  ( $INT'$  is rounded to the current display setting;  
 $INT' = 0$  for period 0 in Begin mode)

$INT = INT'$  (with sign of  $PMT$ )

$PRIN = PMT + INT'$

$BAL_{new} = BAL_{old} + PRIN$

$\Sigma INT_{new} = \Sigma INT_{old} + INT$

$\Sigma PRIN_{new} = \Sigma PRIN_{old} + PRIN$

## Interest Rate Conversions

Periodic compounding

$$\text{EFF\%} = \left[ \left( 1 + \frac{\text{NOM\%}}{100 \times P} \right)^P - 1 \right] \times 100$$

Continuous compounding

$$\text{EFF\%} = \left( e^{\frac{\text{NOM\%}}{100}} - 1 \right) \times 100$$

## Cash Flow Calculations

$j$  = the group number of the cash flow.

$CF_j$  = amount of the cash flow for group  $j$ .

$n_j$  = #TIMES the cash flow occurs for group  $j$ .

$k$  = the group number of the last group of cash flows.

$$N_j = \sum_{1 \leq l < j} n_l = \text{total number of cash flows prior to group } j$$

$$\text{NPV} = CF_0 + \sum_{j=1}^k (CF_j \times \text{USPV}(i\%:n_j) \times \text{SPPV}(i\%:N_j))$$

When  $\text{NPV} = 0$ , the solution for  $i\%$  is  $\text{IRR\%}$ .

$$\text{NFV} = \text{NPV} \times \text{SPFV}(i\%:N) \text{ where } N = \sum_{j=1}^k n_j$$

$$\text{NUS} = \frac{\text{NPV}}{\text{USPV}(i\%:N)}$$

$$\text{TOTAL} = \sum_{j=0}^k (n_j \times CF_j)$$

## **Sum and Statistics**

$n$  = number of items in the list.

$x'$  = an element of the sorted list.

$$\text{TOTAL} = \Sigma x_i$$

$$\text{MEAN} = \bar{x} = \frac{\Sigma x_i}{n}$$

$$\text{MEDIAN} = x_j' \text{ for odd } n, \text{ where } j = \frac{n + 1}{2}$$

$$= \frac{(x_j' + x_{j+1}')}{2} \text{ for even } n, \text{ where } j = \frac{n}{2}$$

$$\text{STDEV} = \sqrt{\frac{\Sigma (x_i - \bar{x})^2}{n - 1}}$$

$$\text{RANGE} = \text{MAX} - \text{MIN}$$

## Forecasting

Model		Transformation	$X_i$	$Y_i$
LIN	$y = A + Bx$	$y = A + Bx$	$x_i$	$y_i$
EXP	$y = Ae^{Bx}$	$\ln(y) = \ln(A) + Bx$	$x_i$	$\ln(y_i)$
LOG	$y = A + B \ln(x)$	$y = A + B \ln(x)$	$\ln(x_i)$	$y_i$
PWR	$y = Ax^B$	$\ln(y) = \ln(A) - B \ln(x)$	$\ln(x_i)$	$\ln(y_i)$

Let:

$$\bar{X} = \frac{\sum X_i}{n} \quad \bar{Y} = \frac{\sum Y_i}{n}$$

$$SX2 = \sum (X_i - \bar{X})^2 \quad SY2 = \sum (Y_i - \bar{Y})^2$$

$$SXY = \sum (X_i - \bar{X})(Y_i - \bar{Y})$$

Then:

$$B = \frac{SXY}{SX2}$$

A = a (LIN, LOG models)

A =  $e^a$  (EXP, PWR models)

$$\text{where } a = \bar{Y} - B \bar{X}$$

$$\text{CORR} = \frac{SXY}{\sqrt{SX2 \times SY2}}$$

# C

## Caring for and Using Your Calculator

### Batteries

The HP-18C is powered by three alkaline batteries. A fresh set of batteries typically will provide approximately six months to one year of use. However, expected battery life depends on how the calculator is used.

Use only fresh N-cell alkaline batteries. Do not use rechargeable batteries.

### Low Power Indicator

When the low battery annunciator ( ) comes on, the HP-18C can continue operating for at least 40 hours. If the calculator is turned off, Continuous Memory will be preserved for approximately one month.

### Installing Batteries

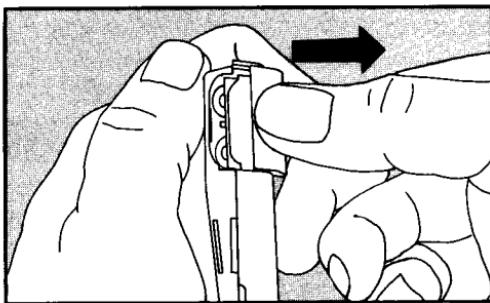
If you have just purchased the HP-18C and are installing the batteries for the first time, you can take as long as you'd like to complete these procedures.

However, if you are replacing batteries, you should keep in mind that there is a time limit for completing these procedures if you want to preserve the information you have stored inside the calculator (Continuous Memory). Once the battery compartment is open, you must replace the batteries and close the compartment within one minute to prevent loss of Continuous Memory. Therefore, you should have the new batteries readily at hand before opening the battery compartment. Also, you must make sure the calculator is off during the entire process of changing batteries.

To install batteries:

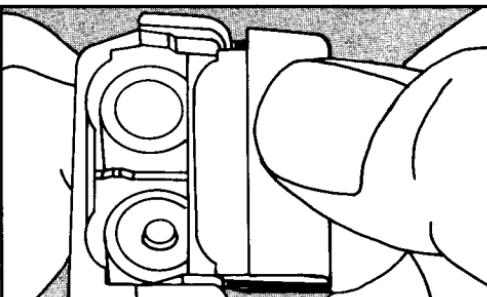
1. Have three fresh N-cell batteries readily at hand.
2. Open the calculator to expose the keyboard and display. If you are replacing batteries, make sure the calculator is off. **Do not press [ON] until the entire procedure for changing batteries is completed. Changing batteries with the calculator on could erase the contents of Continuous Memory.** (If you have any pending alarms stored in memory, check to make sure no alarm will come due while the batteries are out.)
3. Hold the calculator with the battery compartment door facing up. To remove the battery compartment door, slide it towards the back of the calculator (away from the product label).

**Figure C-1. Removing the Battery Compartment Door**



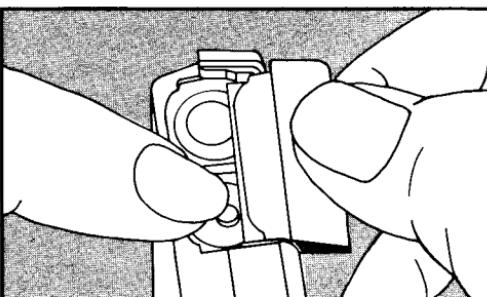
4. Tip the calculator to remove the old batteries.
5. Insert three new batteries. Orient the batteries as shown on the diagram on the back of the calculator. Be certain to observe the polarities (+ and -) as shown.
6. Press the batteries into the compartment using the portion of the battery door that extends beyond the metal contact plate. Press down until the contact plate is lined up with the grooves on the calculator case.

**Figure C-2. Pressing the Batteries Into Place**



7. Slide the contact plate into the grooves. If necessary, use your finger to push the single battery into the compartment so that the door can slide over it. Slide the door until it latches into place.

**Figure C-3. Closing the Battery Compartment Door**



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## **Resetting the Calculator**

If the calculator fails to respond to keystrokes or if it is otherwise behaving unusually, you should attempt to reset it. Resetting the calculator halts the current calculation, clears the calculator line, and displays the **MAIN** menu.

To reset the calculator, hold down the **ON** key while you press the third menu key from the left. It may be necessary to repeat the reset keystrokes several times. The HP-18C displays:

MACHINE RESET

to confirm that reset has occurred. If you are unable to reset the calculator, try installing fresh batteries. If the calculator still fails to operate properly, you should attempt to erase Continuous Memory.

---

## Erasing Continuous Memory

Erasing Continuous Memory is a way of freeing a large amount of memory so that you can use it for other things.

Erasing Continuous Memory:

- Clears the calculator line and history stack.
- Clears all values stored in built-in variables.
- Deletes all formulas you've entered into the SOLVE formula list and their user-variables.
- Clears all number lists, including their names.
- Clears all appointments.
- Sets the calculator to certain "default" settings—month/day/year date format, 12-hour time format, 2 decimal places, period (.) decimal point, and printer tracing off.

Erasing Continuous Memory does not affect the current time and date.

To erase Continuous Memory:

1. Press and hold down the **ON** key.
2. Press and hold down the leftmost menu key.
3. Press the rightmost menu key. (You will be pressing three keys simultaneously).

When the three keys are released, the HP-18C displays:

MEMORY LOST

If the calculator fails to respond to keystrokes and you are unable to restore operation by performing a reset operation or by changing the batteries, erasing Continuous Memory may restore calculator function.

Continuous Memory may inadvertently be erased if the calculator is dropped or if power is interrupted.

---

## Managing Calculator Memory

The HP-18C has approximately 1,200 units (or "bytes") of calculator memory available for your use. Table C-1 describes the amount of memory used by the various types of information you can store. Built-in variables and built-in formulas are not listed; space is allocated to them elsewhere in calculator memory.

The message **INSUFFICIENT MEMORY** informs you that you are attempting to do an operation that uses more calculator memory than is currently available. Many operations require calculator memory—for example, entering alpha mode, switching to certain menus, storing numbers and formulas, naming lists, and creating custom menus.

Here are some suggestions for dealing with this situation:

1. Whenever the message is displayed, you should complete any arithmetic calculations you were in the process of doing in the calculator line (press **=** or **CLEAR**). This frees the memory that was being used to store each of the numbers and operators.
2. If, after completing arithmetic calculations, there is still insufficient memory, you must further reduce the amount of occupied memory. There are a number of ways to do this:
  - If you've named any **SUM** or **CFLO** lists, you can rename them to shorter names (refer to page 111). Or, you can clear any **SUM** or **CFLO** lists you no longer need (refer to page 114). Displaying the **GET** menu requires memory, and you may find that, upon pressing **GET**, only one menu label is displayed. If this label is not the list you want, you can display another label by switching to the list displayed in the **GET** menu and then pressing **GET** again.

- Shorten or delete any messages associated with alarms (refer to page 121).
- Delete any user-variables you no longer need (refer to pages 135 and 136).
- Delete any formulas you no longer need (refer to page 135 and 136).

**Table C-1. Memory Requirements**

Type of Information	Amount of Memory Used
CFLO number lists (excluding the list name)	14½ bytes per list + 9½ bytes for each flow entry (flow amount and #TIMES)
SUM number lists (excluding the list name)	21½ bytes per list + 8 bytes for each item
Number list names	1 byte + 1 byte for each character in the name.
Formulas	1 byte for each character in the formula (spaces are counted as characters)* + 1 byte for each character in the formula name
User-variables	15½ bytes for each variable + 1 bytes for each character in the variable name
Calculator line	Numbers—8 bytes + 1 byte for each character Operators—3½ bytes
Alarm messages	31 bytes for the first message stored + 1 byte for each character in each message

\* The memory requirements of a formula increase while the custom menu for the formula is displayed.

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## **Calculator Maintenance**

To clean the display, use a cloth slightly moistened with water. Avoid getting the calculator wet.

Do not lubricate the hinge.

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## **Clock Accuracy**

The system clock is regulated by a quartz crystal accurate to within three minutes per month for normal operating temperatures. The accuracy of the clock crystal is affected by temperature, physical shock, humidity, and aging. Optimum accuracy is maintained at 25°C (77°F).

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## **Environmental Limits**

In order to maintain product reliability, you should observe the following temperature and humidity limits of the HP-18C:

- Operating temperature: 0° to 45°C (32° to 113°F).
- Storage temperature: -20° to 65°C (-40° to 149°F).
- Operating and storage humidity: 90% relative humidity at 40°C (104°F) maximum.

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## **Safety and Regulatory Information**

For your protection, the HP-18C has been tested to various national and international regulatory standards. This regulatory testing includes electrical/mechanical safety, radio interference, ergonomics, acoustics, and hazardous materials. Where required, approvals obtained from third-party test agencies are shown on the product label. In addition, various regulatory bodies require some of the information under the following headings:

### **U.S.A. Radio Frequency Interference**

The HP-18C generates and uses radio frequency energy and may cause interference to radio and television reception. Although the HP-18C has been tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation, there is no guarantee that interference will not occur in a particular installation. In the unlikely event that there is interference to radio or television reception (which can be determined by turning the HP-18C off and on or by removing the batteries), you are encouraged to correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Relocate the product with respect to the receiver.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find the following booklet, prepared by the Federal Communications Commission, helpful: *How to Identify and Resolve Radio-TV Interference Problems*. This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 004-000-00345-4. At the first printing of this manual, the telephone number was (202) 783-3238.

## **South Africa Radio Frequency Interference**

The HP-18C has been certified to comply with the RFI requirement published in the Government Gazette, dated December, 1979 (number 6794) in notice R2862 and subsequent amendments.

## **Germany Radio Frequency Interference**

The HP-18C has been tested together with its Hewlett-Packard printer and complies with VFG 1046/84, VDE 0871B, and similar non-interference standards.

Should you use equipment that is not manufactured or recommended by Hewlett-Packard, that system configuration has to comply with the requirements of Paragraph 2 of the German Federal Gazette, Order (VFG) 1046/84, dated December 14, 1984.

## **France Radio Frequency Interference**

The HP-18C has been tested together with its Hewlett-Packard printer and complies with all French radio frequency non-interference standards for Class B limits.

Should you use equipment that is not manufactured or recommended by Hewlett-Packard, that system configuration still has to comply with these requirements.

## **Air Safety Notice (U.S.A.)**

The HP-18C and its printer have been tested to the requirements of RTCA (Radio Technical Commission for Aeronautics) Docket 160B, Section 21 and found to comply with those limits. Many airlines permit the use of calculators in flight based on such a qualification. However, before boarding a flight, check with an airline representative on the carrier's policy regarding use of calculators in flight.

# D

## Error Messages

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The HP-18C beeps and displays an error message when you attempt to do an operation that is not allowed. Short error messages are displayed on line 1; longer messages are displayed on lines 1 and 2. Pressing any key erases the error message and restores the previous contents of the display.

The HP-18C distinguishes between math errors that occur on the calculator line and other types of errors (for example, if you attempt an unallowed procedure, or if the HP-18C is not able to do a calculation with its built-in formulas using your data). Messages for math errors on the calculator line start with the word **ERROR:**.

The error messages are listed in alphabetical order.

**CURRENT LIST UNNAMED;  
NAME OR CLEAR THE LIST**

Attempt to GET another list without first clearing or naming the current list.

**EMPTY LIST**

Attempt to do a calculation using an empty number list.

**ERROR: LOGARITHM (NEG)**

Attempt to take the base 10 or natural log of a negative number.\*

**ERROR: LOGARITHM(0)**

Attempt to take the base 10 or natural log of 0.\*

**ERROR: NEG^(NONINTEGER)**

Attempt to raise a negative number to a non-integer power.

**ERROR: OVERFLOW**

An internal result in a calculation was too large for the HP-18C to handle.

**ERROR: SQRT(NEG)**

Attempt to take the square root of a negative number.

**ERROR: UNDERFLOW**

An internal result in a calculation was too small for the HP-18C to handle.

**ERROR: 0^NEG**

Attempt to raise 0 to a negative power.

\* These errors can occur during forecasting calculations:

- Attempt to calculate a logarithmic forecasting model with a negative or zero x-value.
- Attempt to calculate an exponential forecasting model with a negative or zero y-value.
- Attempt to calculate a power forecasting model with a negative or zero x- and/or y-value.

**ERROR: 0÷0**

Attempt to divide 0 by 0.

**ERROR: 0^0**

Attempt to raise 0 to the 0 power.

**ERROR: ÷0**

Attempt to divide by 0.

**INPUTS CAUSED ÷0**

The numbers stored into built-in variables caused a division by 0 in the calculation. You must change one or more stored values.

**INSUFFICIENT DATA**

- Attempt to do curve fitting with only one named SUM list in memory.
- Attempting to do curve fitting using an XLIST in which all the x-values are identical.
- Attempting to calculate standard deviation with only one value in the list.

**INSUFFICIENT MEMORY**

The calculator has insufficient memory available to do the operation you've specified. Refer to **Managing Calculator Memory** on page 189 for additional information.

## **INTEREST <= -100%**

One of the following values is less than or equal to  $-100\%$ :

- TVM menu: I%YR  $\div$  #P/Y.
- EFFCT menu: EFF%  $\div$  P (calculating NOM%); EFF% (calculating NOM%).
- CONT menu: EFF% (calculating NPV, NUS, or NFV).
- CFLO menu: I% or estimate of IRR%.

## **INTERRUPTED**

Calculation of I%YR, IRR%, or a user-variable (in SOLVE) was interrupted.

## **INVALID DATE**

The number entered cannot be interpreted as a proper date.

## **INVALID FORMULA**

The solver cannot interpret the formula.

## **INVALID INPUT**

- Attempt to store into a built-in variable a number that is outside the range of values permitted for that variable.
- The number entered cannot be interpreted as a proper time.
- The alarm repeat interval is out of range.
- Attempt to enter a non-integer, negative number, or alphabetic characters when specifying the number of displayed decimal places (after pressing **FIX**).

## **INVALID N**

Attempt to calculate I%YR with  $N \leq 0.99999$  or  $N \geq 10^{10}$ .

#### INVALID NAME

Attempt to enter an incorrect list name. You cannot enter a blank name or a name consisting entirely of spaces.

IRR%>0 EXISTS; TO SEEK:  
INPUT GUESS [STO] (IRR%)

Calculation of IRR produced a negative answer, but the HP-18C has determined that there is also a unique positive answer. (Refer to page 169.)

#### MANY OR NO SOLUTIONS

The HP-18C is unable to calculate I%YR. Check the values stored in PV, PMT, and FV. Make sure the signs of the numbers are correct. If the values of PV, PMT, and FV are correct, the calculation is too complex for the TVM menu. You may be able to perform the calculation using the CFLO menu (calculate IRR%).

MANY OR NO SOLUTIONS  
INPUT GUESS [STO] (IRR%)

The calculation of IRR% is complex, and requires you to store a guess. (Refer to page 170.)

#### NAME ALREADY USED

The list name or formula name you've attempted to enter is already in use.

#### NO SOLUTION

No solution is possible using the current values stored in the built-in variables.

#### N! N<0 OR N NONINTEGER

Attempt to calculate the factorial of a negative or non-integer value.

## **OVERFLOW\***

Warning; a calculator line result is too large for the HP-18C to handle.

## **SOLUTION NOT FOUND**

No solution was found by the solver using the current values stored in the user-variables. Refer to page 178 for additional information.

## **TRY AGAIN. BAD GUESSES:**

The initial guesses used by the solver are inadequate to find a solution. Refer to page 177 for additional information.

## **UNDERFLOW**

Warning\*; a calculator line result is too small for the HP-18C to handle.

## **UNEQUAL LIST LENGTHS**

Attempt to do a curve fitting calculation using lists of unequal lengths.

## **VALID REGISTERS: 0-3**

You pressed **[STO]** or **[RCL]** followed by a number other than 0 through 3.

\* When the HP-18C displays the message **OVERFLOW** or **UNDERFLOW** during a calculator line operation, it is a warning message. **UNDERFLOW** returns the value 0; **OVERFLOW** returns the value  $\pm 1.00E500$  ( $\pm 9.9999999999E499$  in FIX 11 or FIX ALL display formats).

# E

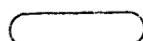
## Menu Maps

---

The following menu maps illustrate how to display each of the menus in the HP-18C. There are six maps—one for each menu label in the MAIN menu. Menu labels for variables are enclosed in boxes to illustrate how they are used:



Variable used to store and/or calculate values.

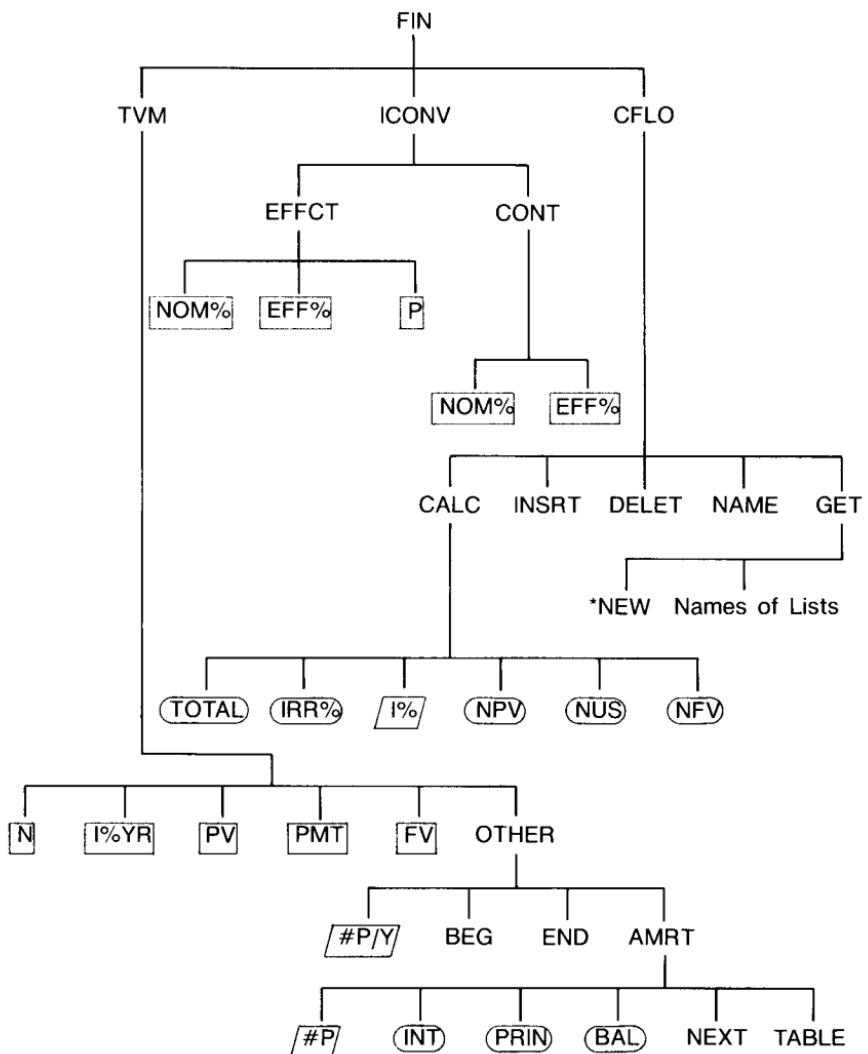


Variable used to calculate or display values; cannot be used to store values.

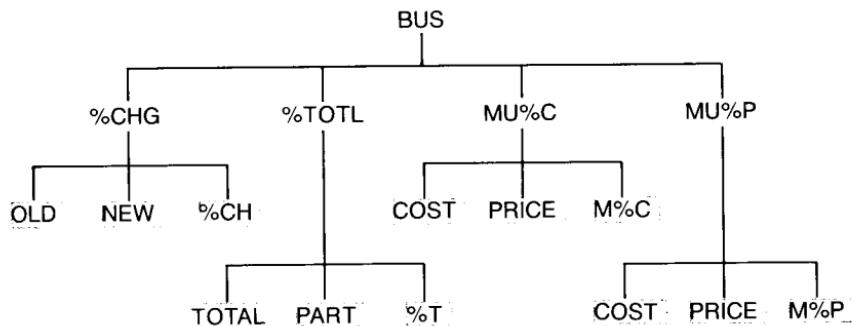


Variable used to store values; cannot be used to calculate values.

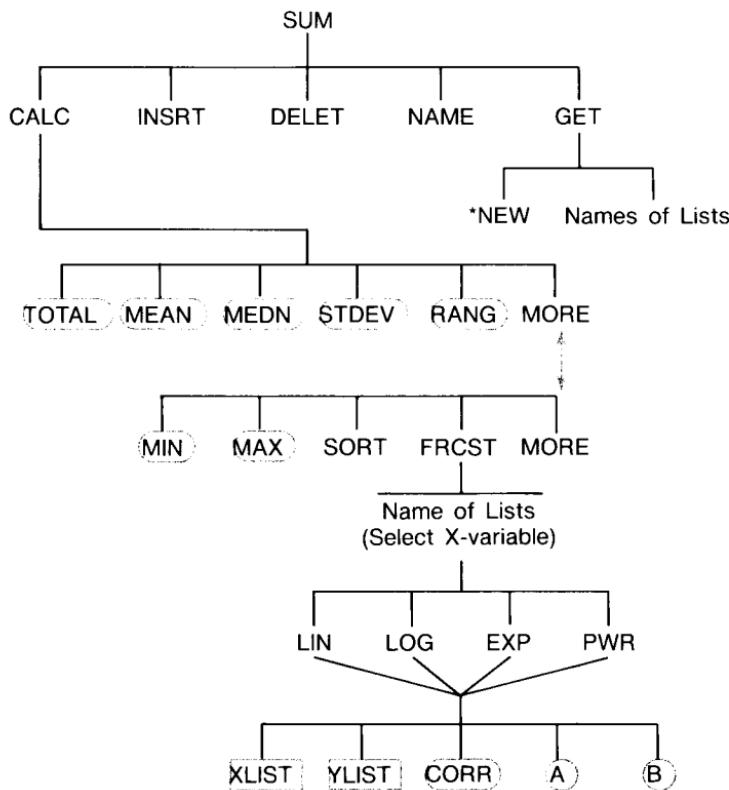
## **FIN Menu Map**



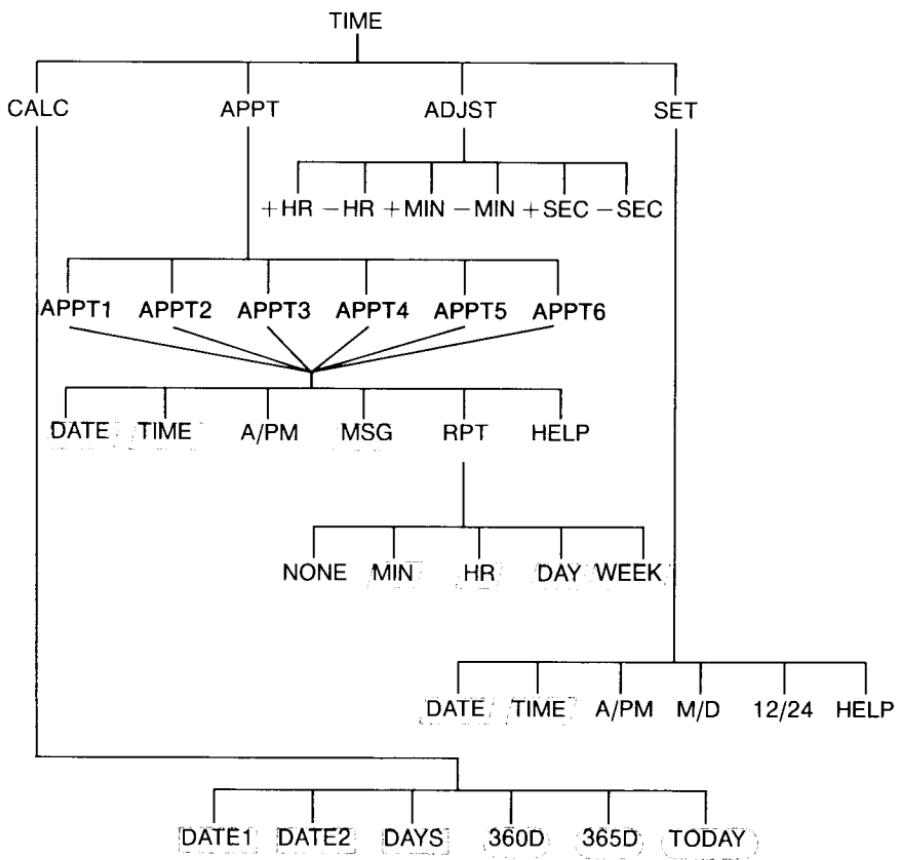
## BUS Menu Map



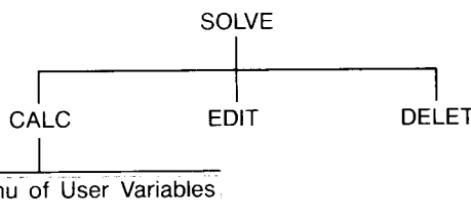
## SUM Menu Map



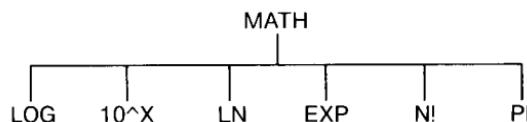
## TIME Menu Map



## SOLVE Menu Map



## MATH Menu Map



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| ■ The manual is well organized.  | 1 | 2 | 3 | 4 | 5 |
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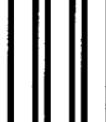
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Appendix A describes how to determine if the calculator requires service. Appendix A also contains important information about obtaining service. If the calculator requires service, mail it to the **Calculator Service Center**:

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