
TRS-80[®]

Model 100 Portable Computer

SPECTACULATOR[®]

Model 100 Spectaculator Addendum

Cat. No. 26-3828

Backup Instructions for Spectaculator Model 100

1. Connect cassette recorder appropriately.
2. Type **LOADM "SP.CO" (ENTER)**, which loads the machine language program called SP.CO from RAM.
3. Type **CSAVEM "SP.CO",55000,62220,55000 (ENTER)**, which will save the machine language program on cassette. After saving SP.CO, return to the Main Menu by pressing **(F0)**.
4. Move the cursor over the text file, SPHELP.DO, and press **(ENTER)**.
5. Press the label function key.
6. Press the function key **(F3)** and the prompt, Save to:, will appear. Then type **CAS: SPHELP.DO (ENTER)**. This file will then be saved on cassette.
7. After following these six steps, the backup is now complete.

Additional Instructions on Loading the SPHELP file (page 3 of Instructor Manual)

1. Place the data tape in the recorder, rewind the tape, and press **PLAY**.
2. At the Model 100 Main Menu, move the cursor over **TEXT**, and press **(ENTER)**.
3. Type: **"SPHELP" (ENTER)**.
4. Press **(F2)** (LOAD), and type **"SPHELP"**. Press **(ENTER)**.
5. The SPHELP file will be automatically saved in memory.

Radio Shack
A DIVISION OF TANDY CORPORATION
FORT WORTH, TEXAS 76102

TERMS AND CONDITIONS OF SALE AND LICENSE OF RADIO SHACK
COMPUTER EQUIPMENT AND SOFTWARE PURCHASED FROM A
RADIO SHACK COMPANY-OWNED COMPUTER CENTER, RETAIL
STORE OR FROM A RADIO SHACK FRANCHISEE OR DEALER AT ITS
AUTHORIZED LOCATION

LIMITED WARRANTY

I. CUSTOMER OBLIGATIONS

- A. CUSTOMER assumes full responsibility that this Radio Shack computer hardware purchased (the "Equipment"), and any copies of Radio Shack software included with the Equipment or licensed separately (the "Software") meets the specifications, capacity, capabilities, versatility, and other requirements of CUSTOMER.
- B. CUSTOMER assumes full responsibility for the condition and effectiveness of the operating environment in which the Equipment and Software are to function, and for its installation.

II. RADIO SHACK LIMITED WARRANTIES AND CONDITIONS OF SALE

- A. For a period of ninety (90) calendar days from the date of the Radio Shack sales document received upon purchase of the Equipment, RADIO SHACK warrants to the original CUSTOMER that the Equipment and the medium upon which the Software is stored is free from manufacturing defects. THIS WARRANTY IS ONLY APPLICABLE TO PURCHASES OF RADIO SHACK EQUIPMENT BY THE ORIGINAL CUSTOMER FROM RADIO SHACK COMPANY-OWNED COMPUTER CENTERS, RETAIL STORES AND FROM RADIO SHACK FRANCHISEES AND DEALERS AT ITS AUTHORIZED LOCATION. The warranty is void if the Equipment's case or cabinet has been opened, or if the Equipment or Software has been subjected to improper or abnormal use. If a manufacturing defect is discovered during the stated warranty period, the defective Equipment must be returned to a Radio Shack Computer Center, a Radio Shack retail store, participating Radio Shack franchisee or Radio Shack dealer for repair, along with a copy of the sales document or lease agreement. The original CUSTOMER'S sole and exclusive remedy in the event of a defect is limited to the correction of the defect by repair, replacement, or refund of the purchase price, at RADIO SHACK'S election and sole expense. RADIO SHACK has no obligation to replace or repair expendable items.
- B. RADIO SHACK makes no warranty as to the design, capability, capacity, or suitability for use of the Software, except as provided in this paragraph. Software is licensed on an "AS IS" basis, without warranty. The original CUSTOMER'S exclusive remedy, in the event of a Software manufacturing defect, is its repair or replacement within thirty (30) calendar days of the date of the Radio Shack sales document received upon license of the Software. The defective Software shall be returned to a Radio Shack Computer Center, a Radio Shack retail store, participating Radio Shack franchisee or Radio Shack dealer along with the sales document.
- C. Except as provided herein no employee, agent, franchisee, dealer or other person is authorized to give any warranties of any nature on behalf of RADIO SHACK.
- D. Except as provided herein, **RADIO SHACK MAKES NO WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**
- E. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation(s) may not apply to CUSTOMER.

III. LIMITATION OF LIABILITY

- A. EXCEPT AS PROVIDED HEREIN, RADIO SHACK SHALL HAVE NO LIABILITY OR RESPONSIBILITY TO CUSTOMER OR ANY OTHER PERSON OR ENTITY WITH RESPECT TO ANY LIABILITY, LOSS OR DAMAGE CAUSED OR ALLEGED TO BE CAUSED DIRECTLY OR INDIRECTLY BY "EQUIPMENT" OR "SOFTWARE" SOLD, LEASED, LICENSED OR FURNISHED BY RADIO SHACK, INCLUDING, BUT NOT LIMITED TO, ANY INTERRUPTION OF SERVICE, LOSS OF BUSINESS OR ANTICIPATORY PROFITS OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OR OPERATION OF THE "EQUIPMENT" OR "SOFTWARE". IN NO EVENT SHALL RADIO SHACK BE LIABLE FOR LOSS OF PROFITS, OR ANY INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF ANY BREACH OF THIS WARRANTY OR IN ANY MANNER ARISING OUT OF OR CONNECTED WITH THE SALE, LEASE, LICENSE, USE OR ANTICIPATED USE OF THE "EQUIPMENT" OR "SOFTWARE".

continued

NOTWITHSTANDING THE ABOVE LIMITATIONS AND WARRANTIES, RADIO SHACK'S LIABILITY HEREUNDER FOR DAMAGES INCURRED BY CUSTOMER OR OTHERS SHALL NOT EXCEED THE AMOUNT PAID BY CUSTOMER FOR THE PARTICULAR "EQUIPMENT" OR "SOFTWARE" INVOLVED.

- B. RADIO SHACK shall not be liable for any damages caused by delay in delivering or furnishing Equipment and/or Software.
- C. No action arising out of any claimed breach of this Warranty or transactions under this Warranty may be brought more than two (2) years after the cause of action has accrued or more than four (4) years after the date of the Radio Shack sales document for the Equipment or Software, whichever first occurs.
- D. Some states do not allow the limitation or exclusion of incidental or consequential damages, so the above limitation(s) or exclusion(s) may not apply to CUSTOMER.

IV. RADIO SHACK SOFTWARE LICENSE

RADIO SHACK grants to CUSTOMER a non-exclusive, paid-up license to use the RADIO SHACK Software on **one** computer, subject to the following provisions:

- A. Except as otherwise provided in this Software License, applicable copyright laws shall apply to the Software.
- B. Title to the medium on which the Software is recorded (cassette and/or diskette) or stored (ROM) is transferred to CUSTOMER, but not title to the Software.
- C. CUSTOMER may use Software on one host computer and access that Software through one or more terminals if the Software permits this function.
- D. CUSTOMER shall not use, make, manufacture, or reproduce copies of Software except for use on **one** computer and as is specifically provided in this Software License. Customer is expressly prohibited from disassembling the Software.
- E. CUSTOMER is permitted to make additional copies of the Software **only** for backup or archival purposes or if additional copies are required in the operation of **one** computer with the Software, but only to the extent the Software allows a backup copy to be made. However, for TRSDOS Software, CUSTOMER is permitted to make a limited number of additional copies for CUSTOMER'S own use.
- F. CUSTOMER may resell or distribute unmodified copies of the Software provided CUSTOMER has purchased one copy of the Software for each one sold or distributed. The provisions of this Software License shall also be applicable to third parties receiving copies of the Software from CUSTOMER.
- G. All copyright notices shall be retained on all copies of the Software.

V. APPLICABILITY OF WARRANTY

- A. The terms and conditions of this Warranty are applicable as between RADIO SHACK and CUSTOMER to either a sale of the Equipment and/or Software License to CUSTOMER or to a transaction whereby RADIO SHACK sells or conveys such Equipment to a third party for lease to CUSTOMER.
- B. The limitations of liability and Warranty provisions herein shall inure to the benefit of RADIO SHACK, the author, owner and/or licensor of the Software and any manufacturer of the Equipment sold by RADIO SHACK.

VI. STATE LAW RIGHTS

The warranties granted herein give the **original** CUSTOMER specific legal rights, and the **original** CUSTOMER may have other rights which vary from state to state.

Spectaculator[®]

Radio Shack
A DIVISION OF TANDY CORPORATION
FORT WORTH, TEXAS 76102

TABLE OF CONTENTS

Introduction	1
Features.....	1
Required Equipment	1
Optional Equipment.....	1
Overview.....	2
Setting Up.....	3
Loading and Saving Spectaculator Files.....	3
The Worksheet.....	5
The Commands.....	6
Moving the Entry Marker	11
Common Errors	12
Spectaculator Commands	13
Enter Text	13
Enter Number.....	14
Change Column Width.....	16
Calculate.....	17
Row Formula Entry.....	18
Column Formula Entry	23
Display Formula	24
Menu.....	24
Insert Row.....	25
Insert Column	25
Delete Row	26
Delete Column.....	26
Clear Row.....	26
Clear Column	27
Move Marker	27
Load from Tape	29
Save on Tape	30
Free Memory	31
List to Printer	31
Partial Save	33
Examples	35
Addition Table.....	35
Inventory Turnover	41
Geometry.....	44
Trigonometry	47
Statistics	50

Spectaculator® Program:
©1983, Tandy Corporation.
All Rights Reserved.

Spectaculator® Program Manual:
©1983, Tandy Corporation.
All Rights Reserved.

Reproduction or use, without express written permission from Tandy Corporation, of any portion of this manual is prohibited. While reasonable efforts have been taken in the preparation of this manual to assure its accuracy, Tandy Corporation assumes no liability resulting from any errors or omissions in this manual, or from the use of the information contained herein.

INTRODUCTION

Model 100 Spectaculator® turns your computer into a sophisticated calculator and your screen into a mini-spreadsheet, divided into rows and columns. After entering formulas and numbers, Spectaculator calculates and displays the computed values automatically. Use Spectaculator for budgeting and forecasting purposes, statistics, engineering — and whatever other time-consuming mathematical applications you can think of. You'll soon find that you're saving not only paper but a lot of valuable time.

Features

- Overtyping for easy error correction
- Delete or insert rows and columns of data
- Save worksheet on tape (as a .CO file) for later use or as a text (.DO) file to insert in another report
- Prepare table format with formulas for easy recalculation to avoid retyping
- Print all or only part of a document

Required Equipment

TRS-80® Model 100 Computer with 16K or greater

AC Power Supply (Radio Shack Catalog Number 26-3804) or 4 AA batteries

Cassette Recorder such as the CCR-81 (Catalog Number 26-1208) and a cassette interface cable

Optional Equipment

Any Radio Shack Parallel Printer compatible with the TRS-80 Model 100, and blank computer cassette tapes for saving data and making program copies

Overview

This manual is divided into several sections. The section, "Setting Up," helps you get familiar with the computer. Basic terms and concepts unique to the Spectaculator program are introduced.

The next section, "Spectaculator Commands," provides a detailed explanation of each command and the various methods and options you can use. This section outlines the "fine" points and offers remedies if any problems should occur.

The last section consists of examples starting with a simple addition table followed by more complicated applications involving business, statistics, geometry, and trigonometry. Detailed instructions and printouts of the finished worksheets are included.

Two quick reference booklets are provided in a binder pocket behind the manual — one specifically for the Spectaculator program, and the other for general use with the Model 100 Computer.

Read the section, "Setting Up," and go through the first example to learn the basics, and refer to "Spectaculator Commands" when you have a particular question involving a command.

SETTING UP

To begin setting up, make sure that the cassette player is properly connected to the Model 100. If you are going to be using a printer, connect it to the computer now. Next, turn on the computer.

Before using Spectaculator, we recommend that you save all RAM files (those files displayed in the Main Menu) on tape as a precautionary measure. Follow the instructions in the "Model 100 Applications Quick Reference" booklet (located behind the manual in a binder pocket) to make copies of all existing files.

Loading and Saving Spectaculator Files

There are two files on the Spectaculator tape: **SP.CO** (the Spectaculator program written in machine-language) and **SPHELP.DO** (a document file containing help information). The **SP.CO** file takes up 7220 bytes and **SPHELP.DO** 2230 bytes.

The best way to use Spectaculator on a Model 100 equipped with at least 24K memory is to save the **SP.CO** file in the computer (RAM) memory. When the computer is turned off, the program remains in the computer's memory. The file will be displayed on the Main Menu after you save it as a RAM file.

If you have a 16K computer, you cannot save **SP.CO** as a RAM file but the program stays in memory until you either run a BASIC program which uses a **CLEAR** statement or load a **.CO** file.

If you have any problems loading or saving files, see the last section, "Common Errors" for solutions.

If you wish to refer to the help screens, load the file, **SPHELP.DO** using the instructions in "Making Copies of Document Files (DO)." It is also a good idea to save the file onto a cassette so that you will have two copies of the file: the original cassette with the **SPHELP.DO** file on it and a backup copy.

Follow these loading instructions exactly. After you load the **SP.CO** file, copy the file onto a cassette using the instructions in "Making Copies of Command Programs (CO)" so that you will have a backup copy of the Spectaculator program.

1. Select **BASIC** from the Main Menu by placing the cursor over **BASIC** and pressing **(ENTER)**. Next type **CLEAR 0,55000 (ENTER)**. The **OK** message reappears.
2. To facilitate the loading process, type **SOUND OFF (ENTER)**.
3. Place the Spectaculator cassette in the tape recorder. Rewind the tape to the beginning, and put the recorder in "Play" mode. Type **CLOADM "SP" (ENTER)**.

After the computer finds and loads the file, the screen shows:

```
Found:SP
Top: 55000
End: 62220
Exe: 55000
OK
```

If your Model 100 is equipped with at least 24K, skip down to Step 4 and follow those instructions to save the **SP.CO** file in memory.

If you have a 16K machine and are sure the **SP.CO** file is intact, follow these steps to execute the Spectaculator program. Select **BASIC** from the Main Menu. (You should see the **OK** message.) Type **CALL 55000 (ENTER)**. The title screen is displayed.

If you are not sure if you have loaded a **BASIC** program with a **CLEAR** statement or a **.CO** file that could have

destroyed part of the Spectaculator program in high memory, load the **SP.CO** file again from tape as a safeguard.

4. Type **SAVEM "SP",55000,62220,55000 (ENTER)** to save **SP.CO** as a RAM file. Press **(F8)** to return to the Main Menu.
5. To execute the Spectaculator program, select **SP.CO** from the Main Menu by placing the cursor over **SP.CO** and pressing **(ENTER)**. The title screen is displayed.

The Worksheet

After you have loaded or executed the **SP.CO** file, the title screen is displayed.

```
SPECTACULATOR

Ver 01.00.00

Copr. 1983, Tandy Corp.
All Rights Reserved

***** Bytes free. Press [ENTER]
```

The version number (vv.rr.pp) indicates how many and what type of revisions have been made to the program. Refer to it when requesting information or help from Radio Shack. The number of bytes free (*****) shown at the bottom of the screen indicates how much room you have in memory to store data.

When operating Spectaculator, all commands are entered in upper case. Make sure the **CAPS LOCK** key is down when operating Spectaculator.

Press **(ENTER)** to continue. You are asked to enter a **Worksheet filename**. Type a filename (up to six characters) and press **(ENTER)**. (This is either a name for a new worksheet file you are about to create, a name for a worksheet you want to load from

tape, or the name of an existing worksheet file currently in memory.) Spectaculator automatically gives a worksheet file a .CO extension and these files all appear in the Main Menu.

After you enter a filename, either an empty worksheet or the worksheet in memory you specified is displayed.

```
6      1      2      3      4      5      6
1[      ]
2
3
4
5
6
ET EN CW CA RF CF DF MENU
```

This is just a small portion of a "worksheet" on which you can enter data. A worksheet can contain up to 99 columns and 99 rows while one screen of a worksheet (called a "window") consists of 6 rows and 6 columns. The solid rectangular box that is currently positioned at Row 1, Column 1 (Cell 1, 1) is called the entry marker. After data is entered, it is displayed in the cell where the entry marker is positioned.

Note: Throughout this manual, the entry marker is indicated by brackets, [].

The width of the column in which the entry marker is currently positioned is shown at the upper-left corner of the screen (right above the first row number). The width of Column 1 is 6. (This is the "default" width value built into the program but you can change the width of any or all columns.)

The Commands

On the last line of the screen is a menu with 8 commands you can use to tell the computer what you want to do. Type ? to see this menu's "help list."

```
COMMAND MENU-1 HELP
ET-Enter Text      RF-Row From,entry
EN-Enter Number   CF-Col,Formu,entry
CW-Change col,width DF-Display Formula
CA-Calculate      ME-Main Menu
                Press [ENTER] to Exit Help,
                then [TAB] for next command Menu
ET  EN  CW  CA  RF  CF  DF  MENU
```

Altogether, there are 20 commands organized into 3 menus. Press **(ENTER)** to exit the help screen and then press **(TAB)** to see the next menu of commands. Type ? to see the second command menu's help list.

```
COMMAND MENU-2 HELP
IR-Insert Row     CR-Clear Row
IC-Insert Column  CC-Clear Column
DR-Delete Row     DF-Display Formula
DC-Delete Column  ME-Main Menu
                Press [ENTER] to Exit Help,
                then [TAB] for next command Menu
IR  IC  DR  DC  CR  CC  DF  MENU
```


Press **(ENTER)** to return to the worksheet, and then press **(TAB)** to see the last command menu line. Type ? to see the help list.

```
COMMAND MENU-3 HELP
MM-Move Marker      LI-List to Printer
LD-Load from Tape  PS-Partial Save
SA-Save on Tape    DF-Display Formula
FR-Free Memory     ME-Main Menu
Press [ENTER] to Exit Help,
then [TAB] for next command Menu
MM  LD  SA  FR  LI  PS  DF  MENU
```

Press **(ENTER)** to return to the worksheet. A brief description of each command follows.

ET — Lets you enter text including letters, numerals, and all other upper and lower case characters (up to 36 characters). Labels (row and column headings) make a worksheet easier to read.

EN — Lets you enter numbers of up to 14 digits including negative numbers and exponential powers ranging from -64 to 62.

CW — Lets you change the column width (the number of spaces a column contains) to any value from 3 to 36. The width of all columns is currently set at 6.

CA — Calculates and displays the values in formula-defined rows and columns.

RF — Lets you enter a row formula to specify how a specific row in the worksheet is to be calculated from data in preceding rows.

CF — Lets you enter a column formula to specify how a specific column is to be calculated from data in preceding columns.

DF — Displays the row and/or column formula previously defined for the cell on which the entry marker is currently positioned.

ME — Lets you return to the Model 100's Main Menu or start a new worksheet.

IR — Inserts rows, allowing you to enter data or create a blank row. Data in succeeding rows shift downward.

IC — Inserts columns, allowing you to enter data or create a blank column. Data in succeeding columns shift to the right.

DR — Deletes data (text and numbers) in a row and any formula associated with that row. Data in succeeding rows shift upwards.

DC — Erases data (text and numbers) in a column and any formula associated with that column. Data in succeeding columns shift to the left.

CR — Clears calculated numbers in a row, without deleting any formula associated with that row. Succeeding rows are not affected.

CC — Deletes calculated numbers in a column, without deleting any formula associated with that column. Succeeding columns are not affected.

MM — Lets you move the entry marker so that you can view any portion of the worksheet.

LO — Loads a worksheet file that was saved on tape, back into memory.

SA — Saves the current worksheet file on tape.

FR — Shows how much room you have in memory to store data. The amount of free memory decreases as you enter data.

LI — Lists (prints) all or part of the current worksheet on a parallel printer.

PS — Lets you save ("cut") a portion of a worksheet as a text file to later insert ("paste") into another text file.

You can select a command in one of two ways. Press the function key (F1 through F8) directly below a command that is currently displayed at the bottom of the screen. Or type the command's two-letter abbreviation (in uppercase) and press (ENTER) for a command that is or is not on display. If the desired command is not on display, press (TAB) until the menu with the command is on the screen.

There are two different kinds of commands. Some commands such as IR (Insert Row) and CA (Calculate) are performed automatically without any further instructions from you. You remain in command mode and the current command menu stays on the bottom of the screen.

Other commands such as ET (Enter Text) and CF (Column Formula) require further instructions from you. After you select one of these commands, you automatically enter input mode. The current command menu disappears and is replaced by an input line where you enter the desired information such as a formula or text. After you enter the information, the input line stays on the screen so that you can use the same command again. When you are finished using the command and wish to return to command mode, press (ENTER). The input line disappears and is replaced with the command menu previously displayed.

Note: If you select a command by mistake, you can also hold down the (SHIFT) key and without releasing (SHIFT), press (PAUSE) to return to command mode.

All commands (except the "automatic" ones) have a "help" list which gives instructions on how to use the command. If the SPHELP.DO file is in memory, you can type ? to see the help list after entering the command. You can enter data on the input line while the help list is still on the screen, or press (ENTER) to return to the worksheet. If the SPHELP.DO file is not in memory and you try to access a menu or command help list, a blank screen is displayed when you type ?. When you press (ENTER), the worksheet screen reappears.

If you make a mistake when typing information on the input line, press the backspace key (located below (↓)) to backspace the cursor and erase the character that was previously there.) To erase the entry at the current marker position during input mode, press (ESC) (below the (F1) key). The entry is erased and you can reenter the data.

To correct an entry after you have returned to command mode, reselect the desired command, move the entry marker to the cell, and simply enter the desired data. After you press (ENTER), the new data replaces the old data.

The data you enter on a worksheet is stored in the computer's memory. The name of the worksheet file appears on the Main Menu with a .CO extension. For safekeeping, you should save worksheet files on data tapes as backups. (See the section on the "Save on Tape" command for instructions.)

Moving the Entry Marker

To move the entry marker up and down or to the right and left, use the four arrow keys. The entry marker moves to the next cell in the direction of the arrow pressed and moves over data without erasing any characters. The worksheet scrolls in the direction of the arrow pressed when you reach the border of the screen. For example, if you press (→) when the entry marker is on Column 6, Column 7 becomes visible and Column 1 scrolls off the screen.

To move the entry marker to the next window, hold down the (SHIFT) key and then press an arrow key. (A window is always six rows by six rows and the next window starts with the last row and last column number of the current window.) For example, if the entry marker is currently on Row 1 and you press (SHIFT) (↓), the entry marker moves to Row 6 and Rows 6-11 become visible.

Common Errors

If you have any problems loading or saving files, you may see one of the following program error messages.

If you see the message, `Memory full`. Press `[ENTER]`., there is not enough room in memory to load the worksheet file. If possible, delete some files from the Main Menu, and then try to load the file again. (See "Deleting Files" in the Model 100 Applications Quick Reference booklet.)

You may also see this message while you are entering data in a worksheet. Press `(ENTER)` to continue and then see the section on the "Free Memory" command for solutions you can turn to in this situation.

If you see the message, `Tape error`. Press `[ENTER]`., try to load the file again. First, check and adjust the volume on your recorder, and make sure everything is properly connected. If you still cannot load the worksheet file, the tape copy may be bad, and you'll just have to reenter the worksheet. If you have a backup of the file, try using that cassette copy.

Also, refer to the section, "Common Problems and Errors," in the Model 100 Applications Quick Reference booklet for details on other error messages (such as BASIC errors).

If you make a mistake while using the Spectaculator program, you will hear a beep to indicate an error. For example, if you enter a command incorrectly with lower case rather than upper case characters, you will hear a beep. Reenter the correct two-letter abbreviation.

If you enter data such as a formula or a number, you hear a beep and see the message `Syntax error`. Press `(ENTER)` to continue. Press the backspace key to erase the incorrect character(s), and then reenter the data correctly.

SPECTACULATOR COMMANDS

There are 18 commands you can use in the creation and editing of worksheets. In this section, each command is discussed in detail by providing a brief description of its function, and specific instructions on how to use the command.

Enter Text

A text entry can contain up to 36 characters. Letters, numerals, and all other upper and lower case characters can be used.

Move the entry marker to the cell where you want to enter text. Press `(TAB)` until you see the menu with the `ET` (Enter Text) command at the bottom of the screen and then press `(F1)`. (You can also type `ET (ENTER)` for this command.) The input line appears at the bottom of the screen. After you type the text and press `(ENTER)`, the text is displayed in the cell. The text is aligned to the left inside the entry marker box.

If you make a mistake, simply move the marker to the cell and reenter the text. The old entry is replaced with the correct text. (If you have not yet pressed `(ENTER)` after typing text, use the backspace key to make corrections.) To erase an entry and leave the cell blank, press `(ESC)`.

After selecting the `ET` command, type `?` to see the `ENTER TEXT HELP` list.

ENTER TEXT HELP

Text is left-justified inside
the marker.
Limit: 36 characters

You can press **(ENTER)** to return to the worksheet, or enter text while the help screen is on display.

To center text over a column, simply press the space bar a few times before entering the text. (You can also use the Change Column Width command to center text.)

To erase unnecessary calculated figures permanently from a worksheet, move the entry marker to the cell, and select the **ET** command. Press the space bar once and then press **(ENTER)**. The next time you use the Calculate command, no calculated figure will be displayed and the cell will remain blank.

Note: You can also enter * in a cell as a reminder that a calculated figure would have been displayed in a cell.

When you are finished entering text, press **(ENTER)**. You return to command mode.

Note: If numbers are entered with the Enter Text command instead of the Enter Number command, calculations are not performed.

Enter Number

Move the entry marker to the cell where you want to enter a number. Press **(TAB)** until you see the menu with the **EN** (Enter Number) command at the bottom of the screen and then press **(F2)**. (You can also type **EN (ENTER)** for this command.) The input line appears at the bottom of the screen. Type ? to see the ENTER NUMBER HELP list.

ENTER NUMBER HELP

Numbers are right-justified inside the marker.

Limits:

- . 14 Significant digits
- . 1×10^{62} and 1×10^{-64}

You can press **(ENTER)** to return to the worksheet, or enter the number while the help screen is on display. After you type the number and press **(ENTER)**, the number is displayed in the cell and is aligned to the right inside the entry marker. When you are finished entering numbers, press **(ENTER)**. The input line is replaced with the previous menu of commands.

You can enter numbers of up to 14 digits (14 digits plus a decimal point). (The column width is currently set at 6. To change the column width to see numbers entered with more than 6 digits, see "Change Column Width.")

In order to see a number entered with the **EN** command, make sure the column width is one plus the number of characters the number entered contains. For example, if the column width of a cell is 6, you can enter a number containing 4 digits plus a decimal point and still see the entire number. The first space of a cell containing an **EN** entry is always left blank so that numbers on the worksheet do not run in to each other and are clearly separated.

You can enter negative numbers and exponential powers ranging from -64 to 62. Precede an exponent with either an **E** for a single-precision number or a **D** for double-precision. (See your Model 100 owner's manual regarding numeric data for details.)

If you enter a wrong number, simply move the marker to the cell, select the **EN** command, and reenter the correct number. The new number replaces the incorrect entry. To erase a number (and leave the cell blank), move the marker to the desired cell and press **(ESC) (ENTER)** while in Enter Number mode.

Change Column Width

You can change the column width (the number of spaces a column contains) from the default value of 6 to any value from 3 through 36. After the width has been changed, the worksheet is displayed (and printed) using the new width.

Press **(TAB)** until you see the menu with the **CW** (Change Width) command at the bottom of the screen and then press **(F3)**. (You can also type **CW (ENTER)** for this command. Type ? to see the **CHANGE COLUMN WIDTH HELP** list. The screen shows:

```
CHANGE COLUMN WIDTH HELP

Enter Col. no, width
      or
"ALL" for col. no. to change
width of all columns.
Limit: 3-36
```

You can enter the Change Column Width instructions while in the **HELP** screen, or press **(ENTER)** to return to the Change Column Width command. To change the width of one column, type that column number, a comma, the value representing the number of spaces wide you want the column to be, and press **(ENTER)**. The worksheet display changes automatically and the input line remains on the screen so that you can enter **CW** instructions. Press **(ENTER)** when you are finished using the **CW** command. The input line disappears and you return to command mode.

To change the width of all columns, type **ALL**. Next, type the width and press **(ENTER)**. The worksheet display changes and you return to command mode.

Be careful when using this command. If you make the width smaller and the data (numbers or text) contains more characters than the newly specified width, some of the characters are erased. Don't worry, however, because the original data is still in the computer's memory. If you change the width again to the original value, the data in its entirety is displayed.

Calculate

To have Spectaculator calculate and display the values in all formula-defined columns and rows, press **(TAB)** until you see the menu with the **CA** (Calculate) command at the bottom of the screen and then press **(F4)**. (You can also type **CA (ENTER)**.) The message, **COMPUTING**, is briefly displayed and then the calculated results are shown. This command is executed automatically without any further instructions from you. You stay in command mode.

If both a row and column formula are entered for the same cell, the value for the row formula is displayed. Spectaculator automatically adjusts the column width to display the entire calculated value.

If a calculated value is greater than 10^{62} or less than 10^{-64} , the message, **Overflow error**, may appear. The value is not displayed. Press **(ENTER)** to return to command mode. You can either change: the formula from "D" to "I" or, the values in the worksheet. Enter the Calculate command again to see the computed values.

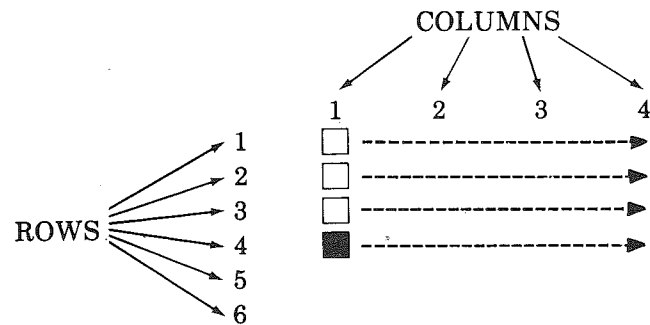
If you try to divide a number by a column or row which contains a 0 number entry, you see the message, **Divide by 0 error**. Press **(ENTER)** to continue, and then either use the **EN** command to change the appropriate column and/or row entry to a non-zero number, or change the formula.

If the formula would result in an invalid mathematical operation (such as taking the square root of a negative number), the message, **Illegal function**, is displayed. Press **(ENTER)** to continue, and then change either the entered number(s) or formula.

Note: Do not reset or turn the computer off during the calculation process. If you do, all files currently in RAM may be lost.

Row Formula Entry

A row formula specifies how values in the row where the entry marker is currently positioned are calculated from data in preceding rows. For example, suppose you want to enter a row formula for Row 4 to add the numbers in Rows 1, 2, and 3. The calculated value in Cell 4,1 is the total of the numbers in Cell 1,1; 2,1; and 3,1. The calculated value in Cell 4,2 is the total of the numbers in Cells 1,2; 2,2; 3,2; etc.



To enter a row formula, move the entry marker to the column where you want the calculated value to appear. (The entry marker can be on any cell in the row.) Press **(TAB)** until you see the menu with the **RF** (Row Formula) command at the bottom of the screen and then press **(F5)**. (You can also type **RF (ENTER)** for this command.) The input line appears at the bottom of the screen. Type **?** to see the ROW FORMULA ENTRY HELP list. The screen shows:

ROW FORMULA ENTRY HELP

```
Operators: + - * / ( ) ^
Functions: SQR SUM SMT MIN MAX
           AVE SIN COS TAN ATN EXP LOG
           ABS SGN FIX INT RND and PI
Type "I" or "D" before formula
for integer or decimal result.
```

All mathematical operations are performed from left to right. Multiplication and division operations are done first, then addition and subtraction are performed (unless enclosed in parentheses). When parentheses occur within another pair of parentheses, operations are performed beginning with the innermost parentheses and working outward.

Multiplication is indicated by an asterisk, *****, while division is indicated by a slash, **/**. Parentheses tell the computer to perform the enclosed operation first. An exponent is indicated by **^** followed by the number showing the exponential power. For example, 10^{-15} would be $10^ - 15$.

There are 18 different functions you can use when entering formulas. (See "BASIC Keywords" in your Model 100 owner's manual for more details on these functions.) To include a function within a formula, type the three-letter abbreviation for the function, and the row number within parentheses.

SQR tells the computer to take the square root of the values in the specified row following the letters **SQR**.

For the next five functions described below, **SUM**, **SMT**, **MIN**, **MAX**, and **AVE**, position the entry marker on the row where you want the calculation to be displayed. (This should be on a row below the last value to be used in the calculation.) Then enter the formula using the desired function followed by the row number from which you want to perform the function. (This is the row containing the first value to be used in the calculation.)

SUM ("sum") adds the values starting from the specified row to the row where the entry marker is positioned or to the row where text is entered. (See the note below for a detailed explanation.) For example, if the entry marker is positioned on Row 5 and you enter the formula, **SUM(R1)**, Spectaculator adds the numbers in Rows 1 through 4. (This is a short cut way of entering the formula $R1 + R2 + R3 + R4$.) After you use the Calculate command, the total is displayed in Row 5.

SMT ("summation") tells the computer to give the cumulative totals along with the final computed total value of one specified row. For example, if the entry marker is positioned on Row 3 and you enter the formula, **SMT(R1)**, followed by the Calculate command, Spectaculator calculates and displays the cumulative sum of the numbers in Row 1. The calculated value in Cell 3,1 is the same value as in Cell 1,1. The sum of Cell 1,1 and Cell 1,2 is displayed in Cell 3,2. Cell 3,3 contains the sum of Cells 1,1; 1,2; 1,3; and so on.

MIN ("minimum") gives the minimum value of the numbers starting from the specified row following the letters **MIN** to the row where the entry marker is positioned or the row where text is entered. **MAX** ("maximum") gives the maximum value of the numbers starting from the specified row following the letters **MAX** to the row where the entry marker is positioned. **AVE** ("average") gives the average value of the numbers starting from the specified row following the letters **AVE** to the row where the entry marker is positioned.

Note: To indicate the last row you want included in a calculation, use the Enter Text command to enter some text such as spaces, dashes, or an asterisk (*) in the next row. For example, suppose you wanted to display the average value of the numbers in Rows 1 through 4 in Row 8. You would enter text in Row 5 to use the numbers through Row 4 for the calculation. Then you would move the entry marker to Row 8 and enter the formula **AVE(R1)**. Even if there were numbers entered in Rows 6 and 7, these numbers would not be used when the average was calculated. The average of the numbers in Rows 1-4 would be displayed in Row 8 when you use the Calculate command.

To use the following trigonometric functions, the values of the angles in the row must be expressed in radians (rather than degrees) when you use the **Enter Number** command. **SIN** gives the trigonometric sines (in radians) of the values in the specified row following **SIN**. **COS** gives the cosines of angles in the specified row following **COS**. **TAN** gives the tangents of the values in specified row following **TAN**. **ATN** gives the arctangents of the values in the specified row following **ATN**.

EXP gives the exponentials (or "natural" antilog) of the values in the specified row following **EXP**. The opposite function, **LOG**, gives the natural logarithms (base "e") of the values in the specified row following **LOG**.

ABS gives the absolute values of the numbers in the specified row following **ABS**. **SGN** (algebraic "sign") gives a -1 for negative numbers, 0 for zero, and 1 for positive numbers for the values in the specified row following **SGN**.

FIX ("truncate real numbers") gives the whole number portions of the values in the specified row following **FIX**. (Numbers to the right of the decimal point are dropped. For negative numbers, **FIX** simply truncates and does not round up to the nearest whole number.) **INT** ("get whole number representation") gives the whole number representations of the values in the specified row following **INT**. (For both negative and positive numbers, **INT** gives the nearest whole number.)

RND ("return pseudo-random number") returns a pseudo-random number between 0 and 1 for the values in the specified row following **RND**. If a row value is non-zero, then **RND** returns a new random number. If a row value equals 0, then **RND** returns the last random number generated.

Type **PI** in a formula to indicate the ratio of the circumference to the diameter of a circle. The number, 3.1415926535898, is used as the value for pi.

You can also specify whether you want the calculated value to be expressed as an integer or decimal number. Simply type **I** or **D** before the formula. If you specify **I**, the calculated value is displayed, showing only the numbers to the left of the decimal. If you choose **D**, the value is carried out to 14 significant digits. Spectaculator automatically deletes trailing zeroes.

If you don't specify "I" or "D," the computer automatically calculates the formula, using a dollar and cents form, by carrying the values out to two decimal places. (This is particularly useful for financial data.)

Type the formula and press **(ENTER)**. You may enter up to 36 characters per formula. You can type the formula while in the help screen or press **(ENTER)** to return to the worksheet. When you are finished entering row formulas, press **(ENTER)** to return to command mode.

If the entry marker is on a cell where both a row and column formula have been entered, the row formula takes precedence. The numbers in the specified rows under each column are used to come up with the computed values.

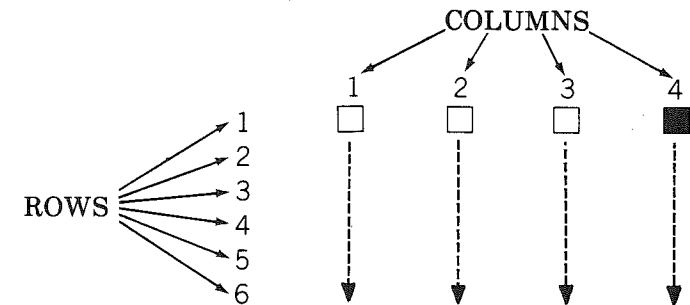
The **SYNTAX ERROR** message appears if you enter a formula incorrectly. Press **(ENTER)** to continue and then press the backspace key to backspace and type over the mistake.

If you wish to change a formula entry, simply move the marker to the desired row, select the **RF** command, and enter the new formula. The new formula replaces the old formula. To delete a formula, move the marker to the desired row, select the **RF** command, and press **(ESC)(ENTER)**.

To review and make sure formulas are entered correctly, use the **DF** (Display Formula) command to display a formula entered for the row in which the entry marker is currently positioned. (See "Display Formula" for details.) After entering formulas, use the **CA** (Calculate) command to see the computed value(s).

Column Formula Entry

A column formula specifies how values, in the column where the entry marker is currently positioned, are calculated from data in preceding columns. For example, suppose you want to enter a column formula for Column 4 to add the numbers in Columns 1, 2, and 3. The calculated value in Cell 1,4 is the total of the numbers in Cells 1,1; 1,2; and 1,3. The calculated value in Cell 2,4 is the total of the numbers in Cells 2,1; 2,2; 2,3; and so on.



To enter a column formula, move the entry marker to the column where you want the calculated value(s) to appear. (The entry marker can be on any cell in the column.) Press **(TAB)** until you see the menu with the **CF** (Column Formula) command at the bottom of the screen and then press **(F6)**. (You can also type **CF (ENTER)**.) The input line replaces the menu at the bottom of the screen. Type the formula and press **(ENTER)**. When you are finished entering column formulas, press **(ENTER)** to return to command mode.

Column formulas are entered the same way row formulas are. (Type ? to see the COLUMN FORMULA ENTRY HELP list. The COLUMN and ROW FORMULA ENTRY HELP screens are identical.)

If you wish to change a formula entry, simply move the marker to the desired column, select the **CF** command, and enter the new formula. The new formula replaces the old formula. To delete a formula, move the marker to the desired column, select the **CF** command, and press **(ESC) (ENTER)**.

Display Formula

If a formula has been entered for the column or row in which the entry marker is currently positioned, you see **C** and/or **R** at the upper-right corner of the screen. If a formula has not been entered for the cell at the entry marker position, the upper-right corner is blank and the **DF** command is not operable.

To display a column (or row) formula, move the entry marker to any cell on the desired column (row). You should see a **C** or an **R** at the upper-right corner. Now press **(F7)**. (You can also type **DF (ENTER)** for this command.) The Display Formula command is on all three menus. The formula is displayed at the lower-left corner of the screen. After looking over the formula, press **(ENTER)** to return to command mode.

If both a column and row formula are entered for a cell, you see **CR** in the upper-right corner. After you press **(F7)**, the column formula is displayed first. Press **(ENTER)** to see the row formula next. Press **(ENTER)** again to return to command mode.

Menu

To return to the Model 100's Main Menu or start a new worksheet, press **(F8)** when any of the three menus are on display. (You can also type **ME (ENTER)** or **MENU (ENTER)** for this command.) The screen shows:

Main Menu or Restart? (M/R)

Press **(M)** to return to the Main Menu. The Main Menu is displayed.

To start a new worksheet, press **(R)**. Press **(ENTER)** at the title screen, and then enter a new `Worksheet filename` (up to six characters). After you enter a name, an empty worksheet is displayed.

If you accidentally pressed **(F8)** and want to remain in the current worksheet, press **(SHIFT) (PAUSE)**. You return to the worksheet and the command menu previously displayed reappears.

Insert Row

To insert a row of data (or blank row), move the entry marker to the desired row. Press **(TAB)** until you see the menu with the **IR** (Insert Row) command and then press **(F1)**. (You can also type **IR (ENTER)** for this command.)

The data and formula originally in that row (and all succeeding rows) shift downward one row. The row numbers in formulas are changed so that the same values are used in calculations. If the row contained no data, another blank row is created. You stay in command mode and the menu line remains on the screen.

Insert Column

To insert a column of data (or a blank column), move the entry marker to the desired column. Press **(TAB)** until you see the menu with the **IC** (Insert Column) command and then press **(F2)**. (You can also type **IC (ENTER)** for this command.)

The data and formula originally in that column (and all succeeding columns) shift to the right one column. If the column did not contain data, another blank column is created. You stay in command mode and the menu line remains on the screen.

Delete Row

To erase text and numbers in a row and any formula associated with that row, you must first position the entry marker on that row. Press **(TAB)** until you see the menu with the **DR** (Delete Row) command at the bottom of the screen and then press **(F3)**. (You can also type **DR (ENTER)** for this command.) Next you are asked **Delete Row? (Y/N)**. Press **(Y)** if you are sure you want to delete all contents of the row. Press **(N)** if you have changed your mind.

The data (and formula if entered) originally in that row is erased. The data (and formula) in the row below shifts up to the row where the entry marker is positioned. The row numbers in formulas are changed so that the same values are used in calculations. Data (and formulas) in succeeding rows also shifts up one row. You return to command mode with the previous menu line displayed on the screen.

Delete Column

To erase data in a column and any formula associated with that column, move the entry marker to that column. Press **(TAB)** until you see the menu with the **DC** (Delete Column) command and then press **(F4)**. (You can also type **DC (ENTER)** for this command.) Next you are asked **Delete Col? (Y/N)**. Press **(Y)** to delete the column. Press **(N)** to keep the contents of the column intact.

The data in the column to the right shifts left to the column where the entry marker is positioned. Data (and formulas) in all succeeding columns shifts one column to the left. You return to command mode with the previous menu line displayed on the screen.

Clear Row

To erase calculated values in a row, move the entry marker to the desired row. Press **(TAB)** until you see the menu with the **CR** (Clear Row) command at the bottom of the screen and then press **(F5)**. (You can also type **CR (ENTER)** for this command.)

Only calculated numbers are erased — if a formula has been entered for that row, it is not affected. Data in succeeding rows remains in the original rows.

The calculated data is erased and you stay in command mode. You can now enter new formulas with the same data or enter new data with the same formulas, and then use the Calculate command to see the computed values.

Clear Column

To erase calculated values in a column (leaving the column formula intact), move the entry marker to the desired column. Press **(TAB)** until you see the menu with the **CC** (Clear Column) command at the bottom of the screen and then press **(F6)**. (You can also type **CC (ENTER)** for this command.)

Data in succeeding columns remain in the original columns.

Note: Both the Clear Column and Clear Row commands are particularly useful when you want to reuse a worksheet and enter new values. You cannot use these commands if no data has been entered.

Move Marker

There is a much faster way than using the arrow keys to move the marker to a particular cell if you are entering data on a large worksheet. Press **(TAB)** until you see the menu with the **MM** (Move Marker) command at the bottom of the screen and then press **(F1)**. (You can also type **MM (ENTER)** for this command.) The menu is replaced with an input line so that you can specify to which cell you want to move the entry marker.

Type ? to see the MOVE MARKER HELP help list. The screen shows:

```
MOVE MARKER HELP

Enter row,col. no.
      or
[ENTER] for cell 1,1
```

Type the row number, a comma, the column number of the cell to which you want to move the entry marker, and press (ENTER). (You can enter the cell coordinates while in the help screen or press (ENTER) to return to the worksheet.)

The screen window changes and the cell you entered occupies the upper-left corner of the screen. You return to command mode and the previous menu line reappears at the bottom of the screen.

For example, if you use the MM command to move the marker to Cell 25,25, the screen shows:

```
  6  25  26  27  28  29  30
25 [  ]
26
27
28
29
30
MM  LO  SA  FR  LI  PS  DF  MENU
```

To move the marker to the "home" cell (Cell 1,1), select the MM command, and then press (ENTER).

Load from Tape

Note: The worksheet screen must be blank when you use this command. You cannot load a worksheet over another worksheet or after a worksheet. You will hear a beep if you try to use the LO command when there is data in the current worksheet. Delete the data or use the MENU command to restart with a blank worksheet.

When you load a worksheet from tape, the worksheet is saved automatically as a RAM file under the most recent filename you specified in response to the Worksheet filename? prompt.

To load a worksheet from tape back into memory, press (TAB) until you see the menu with the LO (Load from Tape) command at the bottom of the screen and then press (F2). (You can also type LO (ENTER) for this command.) The menu is replaced with an input line so that you can enter the name of the file you want to load.

Type ? to see the LOAD FROM TAPE HELP list. The screen shows:

```
LOAD FROM TAPE HELP

1. Ready tape recorder.
2. Type filename, press [ENTER].
```

Place the cassette tape with the worksheet file you wish to load in the tape recorder. Rewind the tape and then put the recorder in "Play" mode. Type the filename of the worksheet and press (ENTER).

If the cassette contains several files or programs, Spectaculator will skip over them until the specified file is found. (Everytime a filename that was not specified is encountered, the message, `SKIP:filename`, is displayed at the bottom of the screen.)

Once the filename has been located, the message, `FOUND:filename`, is displayed, and the worksheet saved under that filename soon appears on the screen. You return to command mode and the previous menu line reappears at the bottom of the screen.

Save on Tape

To save the worksheet currently on the screen onto a cassette tape, press `(TAB)` until you see the menu with the `SA` (Save on Tape) command at the bottom of the screen and then press `(F3)`. (You can also type `SA (ENTER)` for this command.) You return to command mode and the previous menu line reappears at the bottom of the screen. The menu is replaced with an input line so that you can enter a filename under which you want to save the worksheet.

Type ? to see the `SAVE ON TAPE HELP` list. The screen shows:

SAVE ON TAPE HELP

1. Ready tape recorder.
2. Type filename, press `[ENTER]`.

Place a cassette tape in the tape recorder. Either rewind the tape to the beginning, or position the tape to a blank area where you want the copy to start. Put the recorder in "Record" mode, type a filename (up to six characters) and press `(ENTER)`. After the worksheet has been saved and the recorder has

stopped running, you return to command mode and the previous menu line reappears at the bottom of the screen.

Free Memory

To find out how much room you have in memory to store data, press `(TAB)` until you see the menu with the `FR` (Free Memory) command at the bottom of the screen and then press `(F4)`. (You can also type `FR (ENTER)` for this command.) The number of "free" bytes (or characters) left in memory is displayed on the last line of the screen. Press `(ENTER)` to return to command mode and display the previous menu line.

The amount of free memory decreases as you enter data. If there are no characters left in memory, the message, `Memory full`, appears at the top of the screen.

You can run out of memory if you try to:

- enter numbers, text, formulas
- use the Calculate command
- change the column width
- insert rows or columns

If you receive this error message, press `(ENTER)` to continue. You must either delete some data to continue using the same worksheet, or save other `.CO` worksheet files on cassette tape and then delete ("kill") those files from RAM to free more memory. (See the "Model 100 Applications Quick Reference" booklet for details.) You can then return to the previous worksheet and continue entering data.

List to Printer

First, move the entry marker to the first cell to be printed. On the printed copy, this cell appears in the upper-left corner. Next press `(TAB)` until you see the menu with the `LI` command and then press `(F5)`. (You can also type `LI (ENTER)` for this command.) Move the entry marker to the last cell to be printed and then press `(ENTER)` to start printing. On the printed copy, this cell appears in the lower-right corner. (Use `(SHIFT)` with the arrow keys to move the entry marker by windows.) After printing, you return to command mode automatically.

For quick reference, type ? after selecting the LI command to see the LIST TO PRINTER HELP screen. The screen shows:

```
LIST TO PRINTER HELP
1. Ready Printer.
2. Move marker to first cell to be
   printed.
3. Select LI command.
4. Move marker to last cell to be
   printed and press [ENTER].
```

Press **[ENTER]** to return to the worksheet and then enter the desired LI instructions.

For example, suppose you want to print data between Cells 3,1 and 10,8. You would move the entry marker to Cell 3,1, press **[TAB]** until you see the menu with the LI command and then press **[F5]**, and then position the entry marker on Cell 10,8 and press **[ENTER]**. After you press **[ENTER]**, the printing would begin.

	1	2	3	4	5	6	7	8
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								

If the message, Printer not Ready, appears on the screen after you select the LI command, check all cables and plugs. Make sure the printer is ready and on-line, and then press **[ENTER]** to continue. Move the entry marker to the last cell to be printed and then press **[ENTER]** to start the printer.

If you can't get the printer ready or selected the LI command by mistake, press **[SHIFT] [PAUSE]**. The command menu previously displayed reappears.

To center a worksheet on a page, use the Insert Column command at Column 1 to create some blank columns on the left of the page. Usually three columns is sufficient.

Note: You can also press the PRINT key to use the Model 100's print function to print everything that is currently on the screen. However, only one screen at a time can be printed and everything on the screen (such as row and column numbers and the current menu) — not just the data will be printed.

If the printer is not ready when you press the PRINT key, the cursor disappears and the computer "hangs up" and waits until the printer is ready. If you can get the printer ready, printing automatically begins when the printer is put on-line. If you can't get the printer ready, press **[SHIFT] [PAUSE]** to return control of the computer to the Spectaculator program. The command menu previously displayed reappears.

Partial Save

The PS (Partial Save) command lets you save all or part of a worksheet as a text file in RAM so that later you can "cut" this file and insert it in a report (which is another text file with a .DO extension). For example, you may just want to save data of a worksheet (without text or formulas) to be included in a text file.

Before selecting the PS command, move the entry marker to the first cell to be saved. Next press **[TAB]** until you see the menu with the PS command and then press **[F6]**. (You can also

type **PS** **(ENTER)** for this command.) Move the entry marker to the last cell to be saved, type a filename up to six characters with no extension, and press **(ENTER)**. (.DO is automatically used as an extension.) You stay in command mode.

Note: Do not use the name of another .DO file that is currently in RAM and displayed on the Main Menu. If you enter the same filename, the message, File exists, is displayed. Press **(ENTER)** to continue and either use a different filename or return to the Main Menu and delete the other .DO file with the same filename.

For quick reference, type ? to see the PARTIAL SAVE HELP screen after selecting the **PS** command. The screen shows:

```
PARTIAL SAVE HELP
1. Move marker to first cell to be
   saved.
2. Select PS command.
3. Move marker to last cell to be
   saved.
4. Type filename and press [ENTER]
```

Press **(ENTER)** to return to the worksheet. Next, enter the desired **PS** instructions.

As a precautionary measure, save the file again using a different position on the tape.

EXAMPLES

To become familiar with Spectaculator, you should go through the first example below involving the construction of a simple addition table. You learn how to reuse the same table, enter new numbers, and see how Spectaculator recalculates all values. You'll also learn how to print the table.

After you complete the first example, you may want to experiment and try some more complicated examples. These advanced examples will show you some more ways Spectaculator can be used to solve problems. Each worksheet of the five examples has already been saved on the "Samples" tape. After you finish an example, you can load the worksheet from tape and compare it with the one you just created. A printout of the worksheet is provided at the end of each example so that you can see the end result.

Addition Table

If you have not already done so, load the Spectaculator program as instructed in the section, "Setting Up." When you are prompted to enter a **Worksheet filename**, type **TABLE** **(ENTER)**. When the program has loaded, an empty worksheet screen appears.

To enter numbers in the worksheet, press **(F2)** for the **EN** command. Type **1** **(ENTER)**. Next, press **(→)** once to move the entry marker to Cell 1,2 (Row 1, Column 2). Type **2** **(ENTER)**.

To move the cursor to Cell 2,1 press **(←)** once and then **(↓)** once. Type **3** **(ENTER)**. Next, press **(→)** to move the entry marker to Cell 2,2. Type **4** **(ENTER)**. To move the cursor to Cell 3,1, press **(←)** and then **(↓)**. Type **5** **(ENTER)**. Press **(→)** to move the cursor to Cell 3,2.

Type **6** (**ENTER**). The screen looks like this:

6	1	2	3	4	5	6
1	1	2				
2	3	4				
3	5	6				
4						
5						
6						
EN:						

Press (**ENTER**) to exit the EN command. To enter a formula in Column 3, press (**→**), and then press (**F6**) for the **CF** command (Column Formula). To add the numbers in Column 1 and Column 2, type **C1+C2** (**ENTER**).

Press (**ENTER**) to return to command mode. Press (**↓**) to enter a formula in Row 4, and then press (**F5**) for the **RF** command (Row Formula). To add the numbers in Rows 1, 2, and 3, type **R1+R2+R3** (**ENTER**).

Press (**ENTER**) to return to command mode. Press (**F4**) for the **CA** command (Calculate) to see the computed values. The message, **COMPUTING**, is briefly displayed on the bottom of the screen and then the screen shows:

6	1	2	3	4	5	6	CR
1	1	2	3.00				
2	3	4	7.00				
3	5	6	11.00				
4	9.00	12.00	[21.00]				
5							
6							
ET	EN	CW	CA	RF	CF	DF	MENU

Before you use the **ET** command (Enter Text) to enter column and row headings, you're going to insert some blank columns and

rows, and change the width of the worksheet columns to make the table easier to read.

Move the entry marker to the "home" cell (Cell 1,1) by pressing (**TAB**) twice until you see this command menu at the bottom of the screen:

MM	LO	SA	FR	LI	PS	DF	MENU
----	----	----	----	----	----	----	------

Press (**F1**) for the **MM** command (Move Marker), and then press (**ENTER**). Press (**TAB**) until you see the command menu with the **IC** command, and then press (**F2**) to insert a blank column at the extreme left of the table. To insert a blank column between the main table and the calculated values, move the entry marker to Column 4, and press (**F2**). To insert a blank row at the top of the table, press (**F1**) for the **IR** command (Insert Row). Now move the entry marker to Row 5 and press (**F1**) once to insert a blank row between the main table and the calculated values.

To change the column widths, type **CW** (**ENTER**). Next, type **ALL,7** (**ENTER**). Note that the 6 in the upper-left corner has changed to 7 for the new column width. The table looks like the one below. (To see the entire table, use the arrow keys to move the entry marker.)

7	1	2	3	4	5		
1							
2		1	2		3.00		
3		3	4		7.00		
4		5	6		11.00		
5				[1			
6		9.00	12.00		21.00		
IR	IC	DR	DC	CR	CC	DF	MENU

Press **(TAB)** until you see the command line at the bottom of the screen with the **ET** command. Press **(F1)** and then move the entry marker to Cell 1,5, and type **R.Total** **(ENTER)**. To enter the heading for the column total, move the entry marker to Cell 6,1, and then type **C.Total** **(ENTER)**.

Note: If you make a typing mistake, press the backspace key (under the **(V)** key) to backspace the cursor and erase characters.

To separate the column totals from the main table, move the entry marker to Cell 5,2, press the space bar two times, and then type **-----** **(ENTER)**. Follow the same instructions for Cells 5,3 and 5,5. Your table should look like the one below.

7	1	2	3	4	5	C
1						R.Total
2		1	2			3.00
3		3	4			7.00
4		5	6			11.00
5		-----	-----			-----
6	C.Total	9.00	12.00			21.00
ET:						

You can have Spectaculator use the same worksheet format and calculate the same formulas using different numbers.

Press **(ENTER)** to exit the ET command and return to command mode. Using the **EN** command, enter the following numbers. (Remember you can simply overwrite the original numbers.)

- 5 in Cell 2,2
- 6 in Cell 2,3
- 7 in Cell 3,2
- 8 in Cell 3,3
- 9 in Cell 4,2
- 10 in Cell 4,3

Press **(ENTER)** to return to command mode and then press **(F4)** for the **CA** command. The new totals are soon displayed.

Move the entry marker to Column 6. Press **(F6)**, and then for the new column formula, type **SMT(C5)** **(ENTER)**. Press **(ENTER)** to return to command mode, and then press **(F4)** to see the cumulative totals of Column 5. Note that the value in Cell 2,6 is the same value as in Cell 2,5. The cumulative sum of Cells 2,5; 3,5; and 4,5 is displayed in Cell 4,6.

The calculated value in Cell 6,6 was calculated using the original row formula, $R1 + R2 + R3$. Since you inserted a row, the row numbers have changed to: $R2 + R3 + R4$. Remember that if both a column and row formula are entered for the same cell, the row formula is calculated and that resultant value is displayed.

Next, move the entry marker to Cell 1,6. Press **(F1)** for the **ET** command. Press the space bar two times and then type **C.Sum** **(ENTER)**. (This stands for Cumulative Sum.) Move the entry marker to Cell 5,6, press the space bar twice and then type **-----** **(ENTER)**. Press **(ENTER)** to return to command mode.

The new table looks like the one below.

7	2	3	4	5	6	C
1				R.Total	C.Sum	
2	5	6		11.00	11.00	
3	7	8		15.00	26.00	
4	9	10		19.00	45.00	
5	-----	-----		-----	-----	
6	21.00	24.00		45.00	82.00	
ET	EN	CW	CA	RF	CF	DF MENU

To enter a formula to figure the averages of the numbers in Columns 2, 3, 5, and 6, move the entry marker to Row 7. (The average values will be displayed in Row 7.) Press **(F5)** for Row Formula, and then type **AVE(R2)** **(ENTER)**. Press **(ENTER)** to return to command mode and then press **(F4)** to display the column averages.

The formula you just entered instructed the program to start with the number in Row 2 and add the numbers in subsequent rows until it reached a row in which text was entered or a row on which the entry marker was positioned. Then the program took that sum and divided it by the number of rows it used to calculate the sum. When you used the Calculate command, the averages were displayed in Row 7, the row on which the entry marker was positioned when you entered the formula.

Note: If you had not entered text (the dashes) and left Row 5 blank, the column totals in Row 6 would have been added to the numbers in the previous rows, and then the resultant sums would have divided by 4 instead of by 3.

To label the new figures, move the entry marker to Cell 7,1. Select the **ET** command, and then type **C.Aver.** **(ENTER)** for Column Average.

To print the addition table, exit **ET** mode, move the entry marker to Cell 1,1, and then type **LI** **(ENTER)**. Next, move the entry marker to Cell 7,6 (the last cell to be printed). Make sure your printer is ready and on-line, and then press **(ENTER)**. After the printer has stopped, you return to command mode. The printed copy looks like the one below. Note that only data is printed — row and column numbers do not appear on the printed copy.

			R.Total	C.Sum
	5	6	11.00	11.00
	7	8	15.00	26.00
	9	10	19.00	45.00
	-----	-----	-----	-----
C.Total	21.00	24.00	45.00	82.00
C.Aver.	7.00	8.00	15.00	27.33

To see the finished worksheet and compare it with your own, load the worksheet, **ADD.CO** from the Spectaculator "Samples" tape. Follow the instructions in the section, "Load from Tape," on page 29. Remember that the worksheet screen must be blank before you load a worksheet file from tape. (The worksheet you just created is stored and displayed on the Model 100 Main Menu under the filename **TABLE.CO**.)

You have completed the first example. Press **(F8)** for **MENU**. If you'd like to continue with the examples below, press **(R)** to restart Spectaculator with a new worksheet. If you are finished using the program, press **(M)** to return to the Model 100 Main Menu.

Inventory Turnover

The following example shows how to set up a table to calculate inventory turnover to spot trends. These figures indicate how often inventories turn over and must be replaced. To produce this example's printout, follow these steps. To see the finished worksheet and compare it with your own, load the worksheet, **INVENT.CO** from the Spectaculator "Samples" tape. When prompted to enter a **WORKSHEET**

filename, use a different name (other than **INVENT**) such as **TURN** for the filename.

1. Press **(F3)** for the **CW** command (Change Column Width), and then type **ALL,11 (ENTER)** to change the column width to 11.
2. Press **(F1)** for the **ET** command (Enter Text). Move the marker to Cell 1,2 and type **INVENTORY (ENTER)**. To complete the title, move the marker to Cell 1,3 and type **TURNOVER (ENTER)**.

Staying in **ET** mode, move the marker to Cell 3,2, press the space bar five times, and type **YEAR 1 (ENTER)** for the Column 2 heading. Move the marker to Cell 3,3, press the space bar five times, and type **YEAR 2 (ENTER)**. For the last column heading, move the marker to Cell 3,4, press the space bar five times, and type **YEAR 3 (ENTER)**.

Now move the marker to Cell 4,1 and type **COGS (000s) (ENTER)**. This stands for Cost of Goods Sold. This figure and all others in the table are in thousands of dollars.

Next move the marker to Cell 5,1 and type **BEG. INV. (ENTER)**. This stands for Beginning Inventory. Move the marker to Cell 6,1 and type **END. INV. (ENTER)** for Ending Inventory. Move the marker to Cell 7,1 and type **AVG. INV. (ENTER)** for Average Inventory.

In Cell 8,1 type **TURNOVER(x) (ENTER)**. This stands for the number of times in a year that inventory turns over. In Cell 9,1, type **AVG. DAYS (ENTER)**. Move the marker to Cell 10,1 and type **TO TURNOVER (ENTER)**. This figure expresses turnover as the average number of days it takes to turn over inventory.

3. Press **(ENTER)** to return to command mode and then press **(F5)** for the **RF** command (Row Formula). Move the marker to any cell on Row 7, and type **IAVE(R5) (ENTER)**. This formula rounds the average turnover to the nearest whole dollar.

Move the marker to Row 8, and type **R4/R7 (ENTER)**. For the last formula, move the marker to Row 10, and type **365/R8**

(ENTER). This formula divides the number of days in the year by the number of times inventory turns over in a year.

4. Press **(ENTER)** to return to command mode, and then press **(F2)** for the **EN** command (Enter Number). Enter these numbers in the cells indicated for Years 1-3.

1500 **(ENTER)** in Cell 4,2
1450 **(ENTER)** in Cell 4,3
1725 **(ENTER)** in Cell 4,4

300 **(ENTER)** in Cell 5,2
500 **(ENTER)** in Cell 5,3
650 **(ENTER)** in Cell 5,4

500 **(ENTER)** in Cell 6,2
650 **(ENTER)** in Cell 6,3
450 **(ENTER)** in Cell 6,4

5. Press **(ENTER)** to return to command mode, and then press **(F4)** for the **CA** command (Calculate) to see the computed values.
6. Move the marker to Cell 1,1, and then press **(TAB)** until you see the menu with the **IC** (Insert Column) command at the bottom of the screen. To center the worksheet before printing, press **(F2)** two times.

Make sure your printer is ready, and then press **(TAB)** until you see the menu with the **LI** (List to Printer) command at the bottom of the screen. Press **(F5)**, move the marker to Cell 10,6 and then press **(ENTER)** to start printing.

Later, you can include more years of data and overwrite to enter new values for the **COGS**, **BEG. INV.**, and **END. INV.** figures using the **EN** command. Spectaculator uses the formulas to recalculate and display the new values after you select the **CA** command.

INVENTORY TURNOVER

	YEAR 1	YEAR 2	YEAR 3
COGS (000s)	1500	1450	1725
BEG. INV.	300	500	650
END. INV.	500	650	450
AVG. INV.	400	575	550
TURNOVER(x)	3.75	2.52	3.14
AVG. DAYS TO TURNOVER	97.33	144.84	116.24

Geometry

The following formulas are used to calculate the circumference and area of a circle, and the volume and surface area of a sphere:

$$\text{Circumference} = 2\pi r$$

$$\text{Area of Circle} = \pi r^2$$

$$\text{Volume of Sphere} = \frac{4}{3}\pi r^3$$

$$\text{Surface Area of Sphere} = 4\pi r^2$$

where:

$$\pi = \text{Pi (3.1415926535898)}$$

r = Radius

To produce this example's printout, follow these steps. To see the finished worksheet and compare it with your own, load the worksheet, **GEOMET.CO** from the Spectaculator "Samples" tape. When prompted to enter a `Worksheet filename`, use a different name (other than **GEOMET**) such as **RADII** for the filename.

1. Press **F3** for the **CW** command (Change Column Width), and then enter these column width values, one by one.

1,6 **ENTER**

2,3 **ENTER**

3,10 **ENTER**

4,3 **ENTER**

5,10 **ENTER**

6,3 **ENTER**

7,10 **ENTER**

8,3 **ENTER**

9,10 **ENTER**

2. Press **ENTER** to return to command mode and then press **F2** for the **EN** command (Enter Number). Enter these numbers in Column 1 for the radii values.

1 **ENTER** in Cell 1,1

5 **ENTER** in Cell 2,1

7 **ENTER** in Cell 3,1

83 **ENTER** in Cell 4,1

100 **ENTER** in Cell 5,1

3. Press **ENTER** to return to command mode and then press **F6** for the **CF** command (Column Formula). Move the marker to Column 3, and type **2*PI*C1** **ENTER** to enter a formula to calculate the circumference.

Note: When you specify **PI** in a formula, Spectaculator uses 3.1415926535898 as the value for pi.

Stay in Column Formula Entry mode, move the marker to Column 5, and type **PI*C1^2** **ENTER** to enter the column formula to calculate the area of the circle.

Move the marker to Column 7, and type **(4/3)*PI*C1^3** **ENTER** to enter a column formula to calculate the volume of the sphere.

Move the marker to Column 9, and type **4*PI*C1^2** **ENTER** to enter a column formula to calculate the surface area of the sphere.

4. Press **(ENTER)** to return to command mode, and then press **(F4)** for the **CA** command (Calculate) to see the computed values.
5. Move the marker to Cell 1,1, and then press **(TAB)** until you see the menu with the **IR** (Insert Row) command at the bottom of the screen. Press **(F1)** three times to create three blank rows.
6. Press **(TAB)** until you see the menu with the **ET** (Enter Text) command, and then press **(F1)**. Type **Radius** **(ENTER)** for the Column 1 heading.

Stay in Enter Text mode and move the marker to Cell 1,3. Press the space bar three times and then type **Circum-****(ENTER)**. Move the marker to Cell 2,3 and press the space bar three times. Type **ference** **(ENTER)** as the rest of the Column 3 heading.

Move the marker to Cell 1,5 and press the space bar three times. Type **Area of** **(ENTER)** as part of the Column 5 heading. Move the marker to 2,5 and press the space bar three times. Type **Circle** **(ENTER)** to complete the heading.

Move the marker to Cell 1,7 and press the space bar once. Type **Volume of** **(ENTER)**. Move the marker to Cell 2,7 and press the space bar once. Type **Sphere** **(ENTER)** as the rest of the Column 7 heading.

Move the marker to Cell 1,9, and type **Surf. Area** **(ENTER)**. Move the marker to Cell 2,9 and type **of Sphere** **(ENTER)** to complete the heading.

7. Press **(ENTER)** to return to command mode, and then move the entry marker to Cell 1,1. Press **(TAB)** until you see the menu with the **IC** (Insert Column) command. To center the worksheet before printing, press **(F2)** two times.

Press **(TAB)** until you see the menu with the **LI** (List to Printer) command. Make sure your printer is ready and then when the marker is on Cell 1,1, press **(F5)**. Next, move the marker to Cell 8,11 and then press **(ENTER)** to start printing.

Later, you can overwrite the values in Column 3 to enter new values for the radii using the **EN** command. Spectaculator uses the formulas to recalculate and display the new values after you select the **CA** command.

Radius	Circum- ference	Area of Circle	Volume of Sphere	Surf. Area of Sphere
1	6.28	3.14	4.19	12.57
5	31.42	78.54	523.60	314.16
7	43.98	153.94	1436.76	615.75
83	521.50	21642.43	2395095.78	86569.73
100	628.32	31415.93	4188790.20	125663.71

Trigonometry

In this session, you are given a trigonometric equation for a sine function and various degree values for angles.

The following formula is used to convert degrees into radians:

$$2\pi/360 \times A^\circ$$

The sine function to be solved is:

$$y = \sin 2A + \sin A - 1/4$$

To produce this example's printout, follow these steps. To see the finished worksheet and compare it with your own, load the worksheet, **TRIG.CO**, from the Spectaculator "Samples" tape. When prompted to enter a **Worksheet** filename, use a different name (other than **TRIG**) such as **SIN** for the filename.

1. Press **(F2)** for the **EN** command (Enter Number), and enter these numbers in Column 1 for the degree values of the angles.

0 **(ENTER)** in Cell 1,1
 15 **(ENTER)** in Cell 2,1
 30 **(ENTER)** in Cell 3,1
 45 **(ENTER)** in Cell 4,1
 60 **(ENTER)** in Cell 5,1
 75 **(ENTER)** in Cell 6,1

90 **(ENTER)** in Cell 7,1
 105 **(ENTER)** in Cell 8,1
 120 **(ENTER)** in Cell 9,1
 135 **(ENTER)** in Cell 10,1

- Press **(ENTER)** to return to command mode and then press **(F6)** for the **CF** command (Column Formula). Move the marker to Column 2, and type **D2*PI/360*C1 (ENTER)**. This formula converts the degree values in Column 1 to radians. Angles must be expressed in radians in order to use Spectaculator's trigonometric functions.

Note: When you specify **PI** in a formula, Spectaculator uses 3.1415926535898 as the value for pi.

Staying in **CF** mode, move the marker to Column 3, and type **SIN(2*C2) + SIN(C2) - 1/4 (ENTER)**. This formula provides the solutions for this particular trigonometric function.

- Press **(ENTER)** to return to command mode, and then press **(F4)** for the **CA** command (Calculate) to see the computed values.
- Press **(F3)** for the **CW** command (Change Column Width), and then type **3.8 (ENTER)** to make Column 3 wider.
- Press **(ENTER)** to return to command mode. Move the marker to Cell 1,1, and then press **(TAB)** until you see the menu with the **IR** (Insert Row) command at the bottom of the screen. Press **(F1)** twice to create two blank rows.
- Press **(TAB)** until you see the menu with the **ET** (Enter Text) command, and then press **(F1)**. Press the space bar three times and then type **Ang (ENTER)**. Move the marker to Cell 1,2, and type **1e**. Stay in Cell 1,2 and do not press **(ENTER)** yet. For the Column 2 heading, press the space bar three times and then type **Radians (ENTER)**.

To complete the Column 1 heading, stay in **ET** mode, and move the marker to Cell 2,1. Type in **Deg (ENTER)**. Move the marker to Cell 2,2, and type **rees (ENTER)**.

For the Column 3 heading, move the marker to Cell 1,3, press the space bar twice, and then type **Sine (ENTER)**. Next, move the marker to Cell 2,3, and type **Function (ENTER)**.

- Press **(ENTER)** to return to command mode, and then move the entry marker to Cell 1,1. Press **(TAB)** until you see the menu with the **IC** (Insert Column) command. To center the worksheet before printing, press **(F2)** two times.

Press **(TAB)** until you see the menu with the **LI** (List to Printer) command. Make sure your printer is ready and then when the marker is on Cell 1,1, press **(F5)**. Next, move the marker to Cell 12,5 and then press **(ENTER)** to start printing.

To check the accuracy of the solution values, you could plot the points using degrees (or radians) on the X axis and the solution values for the sine function on the Y axis to draw a curve. Then, enter new degree values in Column 3 to obtain new points on the graph and see how closely these points fall on the curve.

Angle in Degrees	Radians	Sine Function
0	0	-0.25
15	.26179938779915	.51
30	.52359877559829	1.12
45	.78539816339744	1.46
60	1.0471975511966	1.48
75	1.3089969389957	1.22
90	1.5707963267949	.75
105	1.832595714594	.22
120	2.0943951023932	-0.25
135	2.3561944901923	-0.54

Statistics

To calculate the chi-square statistic, the following formula is used:

$$\chi^2 = \sum \frac{(OF - EF)^2}{EF}$$

where:

- χ^2 = Chi-square (chi is a Greek letter)
 Σ = Symbol meaning "the sum of"
OF = An observed frequency
EF = An expected frequency

To produce this example's printout, follow these steps. To see the finished worksheet and compare it with your own, load the worksheet, **STATS.CO**, from the Spectaculator "Samples" tape. When prompted to enter a **Worksheet filename**, use a different name (other than **STATS**) such as **CHISQ** for the filename.

1. Press **(F3)** for the **CW** command (Change Column Width), and then enter these column width values, one by one.

1.8 **(ENTER)**
2.8 **(ENTER)**
3.12 **(ENTER)**
4.18 **(ENTER)**

2. Press **(ENTER)** to return to command mode and then press **(F2)** for the **EN** command (Enter Number). Enter these numbers in Column 1 for the observed frequencies.

68 **(ENTER)** in Cell 1,1
75 **(ENTER)** in Cell 2,1
57 **(ENTER)** in Cell 3,1
79 **(ENTER)** in Cell 4,1
32 **(ENTER)** in Cell 5,1

Enter these numbers in Column 2 for the expected frequencies.

61 **(ENTER)** in Cell 1,2
80 **(ENTER)** in Cell 2,2
60 **(ENTER)** in Cell 3,2

73 **(ENTER)** in Cell 4,2
39 **(ENTER)** in Cell 5,2

3. Press **(ENTER)** to return to command mode, and then press **(F6)** for the **CF** command (Column Formula). Move the marker to Column 3 and then type **(C1 - C2)^2 (ENTER)**.

Stay in **CF** mode, move the marker to Column 4, and then type **D(C3/C2) (ENTER)** (Decimal Column Formula). Answers will be calculated to 14 significant digits.

4. Press **(ENTER)** to return to command mode, move the marker to Row 7, and then press **(F5)** for the **RF** command (Row Formula). Type **DSUM(R1) (ENTER)**.
5. Press **(ENTER)** to return to command mode, and then press **(F4)** for the **CA** command to see the calculated values.
6. Move the marker to Cell 1,1, and then press **(TAB)** until you see the menu with the **IR** (Insert Row) command at the bottom of the screen. To insert five rows to make room for the title and column headings, press **(F1)** five times.

To insert one column at the left of the table, press **(F2)** one time for the **IC** command (Insert Column).

7. Move the marker to Cell 1,4, and then press **(TAB)** until you see the menu with the **ET** (Enter Text) command. Press **(F1)**, and then for the title of the table, type **CHI-SQUARE (ENTER)**. Move the marker to Cell 1,5, and type **STATISTIC (ENTER)**.

Stay in the **ET** mode, move the marker to Cell 4,2, and press the space bar six times. For the column heading, type **OF (ENTER)** which stands for Observed Frequencies.

Move the marker to Cell 4,3, and press the space bar six times. For the Column 3 heading, type **EF (ENTER)** which stands for Expected Frequencies.

Move the marker to Cell 4,4, and press the space bar four times. Type **(OF - EF)^2 (ENTER)**. This stands for the formula to subtract the Expected Frequency from the Observed Frequency, and then, to square the difference.

Move the marker to Cell 4,5, press the space bar three times, and then type $(OF - EF)^2/EF$ (ENTER). This stands for the formula to divide the squared differences by the Expected Frequency.

8. To erase the unnecessary figures in Cells 12,2; 12,3; and 12,4, stay in ET mode. Move the marker to Cell 12,2, press the space bar one time, and then press (ENTER). To erase the numbers in Cell 12,3 and 12,4, repeat this process.
9. In Cell 12,4, type CHI-SQUARE = (ENTER). Press (ENTER) to return to command mode.
10. Move the marker to Cell 1,1, and then press (TAB) until you see the menu with the LI (List to Printer) command. Make sure your printer is ready, and press (F5). Next, move the marker to Cell 12,5 and then press (ENTER) to start printing.

Later, you can enter new values for the observed and expected frequencies in Columns 2 and 3 using the EN command. Speculator uses the formulas which are still intact to recalculate and display the new values when you use the CA command.

CHI-SQUARE STATISTIC

OF	EF	(OF-EF)2	(OF-EF)2/EF
68	61	49.00	.80327868852459
75	80	25.00	.3125
57	60	9.00	.15
79	73	36.00	.49315068493151
32	39	49.00	1.2564102564103
CHI-SQUARE =		3.0153396298664	

Cat. No. 26-3828



Printed in U.S.A.