11

Time, Appointments, and Date Arithmetic

The calculator contains a clock and calendar in the TIME menu. You can select a 12-hour or 24-hour clock, and a month-day-year or day-month-year calendar. You can:

- Record appointments that 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, the 365-day, or the actual calendar.

Viewing the Time and Date

To view the time and date, press TIME in the MAIN menu.

If you overwrite the time and date, you can restore them to the display by pressing CLR.

The TIME Menu

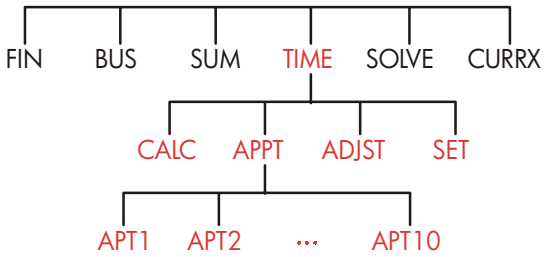


Table 11-1. The TIME Menu Labels

Menu Label	Description
CALC	Displays the CALC menu, for calculating the day of the week and other date arithmetic.
APPT	Displays the APPT menu for setting and viewing appointments.
ADJST	Displays the ADJST menu for adjusting the clock setting.
SET	Displays the SET menu for setting the time and date, and for selecting the time and date formats.

Setting the Time and Date (SET)

Table 11-2. The SET Menu Labels

Menu Label	Description
DATE	Sets the date to the displayed number (*MM.DDYYYY* or *DD.MMYYYY*).
TIME	Sets the time to the displayed number (*HH.MMSS*).
A/PM	Switches between AM and PM (12-hour clock).
M/D	Switches between month/day/year and day.month.year formats.
12/24	Switches between 12-hour and 24-hour clock formats.
HELP	Displays the formats for entering the clock's date and time.

To set the time:

1. Press TIME SET to display the SET menu.
2. Key in the correct time in the current format (A or P indicates the 12-hour clock). For example, for 9:08:30 p.m. enter 9.0830 in a 12-hour clock or 21.0830 in a 24-hour clock.
3. Press TIME to set the new time.
4. For 12-hour format: press A/PM to switch between AM and PM.

To set the date:

1. Key in the correct date in the current format. For example, for April 3, 2003 enter 4.032003 in month/day/year format or 3.042003 in day.month.year format.
2. Press DATE.

Example: Setting the Date and Time. Set the date and time to April 5, 2003, 4:07 p.m.

Keys:	Display:	Description:
SET		Displays SET menu.
4.052003	SAT 04/05/03 *time*	Sets date.
DATE		
4.07 TIME		Sets time. Press A/PM if
A/PM	SAT	necessary.
	04/05/03 04:07:xxP	

Changing the Time and Date Formats (SET)

Use the SET menu to change the time and date formats. To switch between the 12- and 24-hour clocks, press 12/24. To switch between the month/day/year and day.month.year calendars, press M/D.

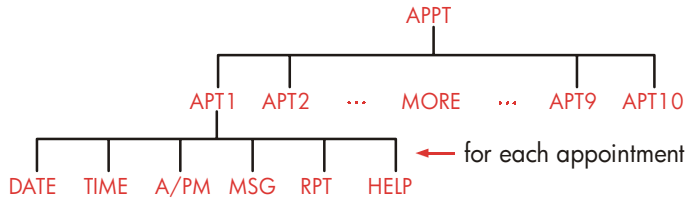
Adjusting the Clock Setting (ADJST)

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

1. Press TIME 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.

Appointments (APPT)

You can record up to ten appointments, each with an alarm. An appointment can contain a message. You can also create *repeating appointments*—appointments that recur at regular intervals.



Viewing or Setting an Appointment (APT1-APT10)

Table 11-3. Menu Labels for Setting Appointments

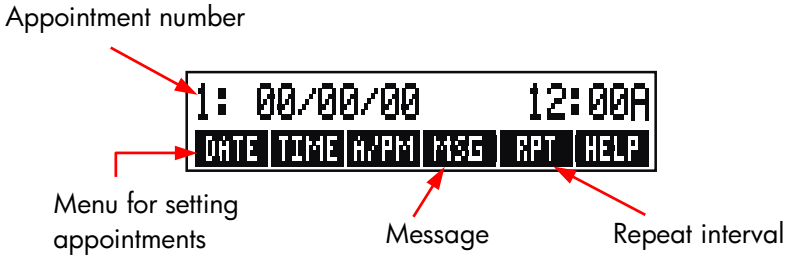
Menu Label	Description
DATE	Sets the appointment date.
TIME	Sets the appointment time, *and* automatically enters the current date (if the existing appointment date was in the past).
A/PM	Sets AM or PM for 12-hour clock.
MSG	Displays the ALPHA menu and any existing message.
RPT	Displays the existing repeat interval and the menu for changing the repeat interval.
HELP	Displays the format for entering the date and time.

To set an appointment or view its current setting:

1. Press TIME, then APPT. The display tells you which appointments (numbered 1-10) are *set* and which are *past due* (expired with unacknowledged alarms).

   Pressing MORE displays the status and menu labels for appointments 6 through 10.

2. Press a menu key — APT1 through APT10. The display shows the current appointment, if any, and the menu labels for setting appointments.
3. Optional: press CLR DATA to remove any old information.



4. **Setting the appointment time:** Use 12-hour or 24-hour time, as appropriate. Key in the time as a number in the form *HH.MM*. For example, 2:25 p.m. would be 2.25 (12-hour format) or 14.25 (24-hour format). Press TIME. *The date is automatically set to the current date* if the existing date is in the past or was cleared.

   For 12-hour format: press A/PM to switch between AM and PM.

5. **Setting the appointment date:** Key in the date in the current date format. For example, enter October 4, 2003 as 10.042003 (month/day/year format) or 4.102003 (day.month.year format). Press DATE. *If the appointment is within a year from today, you can omit the year.*
6. **The appointment message (optional):** To set, change, or just view a

message, press MSG. Type the message (refer to page 30 for using the ALPHA menu). Messages are limited to a maximum of 22 characters. Press INPUT when done. (Press EXIT to negate any changes and retain the original message.)

7. **The repeat interval (optional):** To set, view, or change a repeat interval, press RPT. Key in an integer and press the appropriate key. For example, 2 DAY causes the appointment to go off at the same time every other day; 90 MIN sets the repeat interval to 1½ hours. NONE sets the appointment to non- repeating. You can specify repeat intervals up to 104 weeks in length (728 days, 17,472 hours, etc.)
8. When done, press EXIT to return to the APPT menu. The appointment you just set will be recorded, such as SET:1. You can check an appointment by pressing its menu key (such as APT1).

CLR restores an appointment's time and date to the display if it has been overwritten by other operations.

Acknowledging an Appointment

To acknowledge the appointment and clear the message, press any key (except ▬) during the beeping. Appointments not acknowledged within 20 seconds become past due.

When an appointment "comes due," the alarm starts beeping and the alarm annunciator ((●)) is displayed, even if the calculator was off.*† The message (or, if none, the time and date) is displayed.

* If the calculator is in the middle of a complex calculation when an appointment comes due, the alarm annunciator comes on and the calculator beeps once. When the calculation is done, the alarm goes off.

† The beeping can be suppressed or restricted to appointments. See "Beeper On and Off," page 36.

Unacknowledged Appointments

An appointment not acknowledged during its alarm becomes past due. The alarm annunciator remains on.

To acknowledge a past-due appointment:

1. Press TIME APPT .
2. Press the menu key for the past-due appointment.
3. Press EXIT to return to the APPT menu. The acknowledged appointment is no longer listed as past due.

A repeating appointment is deactivated while it is past due and will not go off subsequently until the past-due appointment has been acknowledged.

Clearing Appointments

To cancel an appointment or to get rid of a repeating appointment, you need to *clear* the appointment. Clearing changes the date and time to 00/00/00, 12:00 AM, and removes the message and the repeat interval.

To clear an appointment, press the menu label for that appointment and press ▬ CLR DATA

To clear all ten appointments, display the APPT menu (the menu with APT1 , APT2 etc.) and press ▬ CLR DATA YES .

Example: Clearing and Setting an Appointment. Today is Sunday, April 20, 2003. You want to set appointment #4 to go off every Tuesday at 2:15 p.m. to remind you of a staff meeting. Assume 12-hour time format and month/day/year date format.

Keys:	Display:	Description:
TIME APPT		Displays setting for

APT4		appointment #4.
↓ CLR DATA	4: 00/00/00 12:00A	Clears appt. #4.
2.15 TIME	4: SUN 04/20/03 2:15A	Stores appt. time *and* supplies current date.
A/PM	4: SUN 04/20/03 2:15P	Sets appt. time to PM.
4.22 DATE	4: TUE 04/22/03 2:15P	Stores appt. date.
MSG		Enters message: "staff".
STAFF INPUT	4: TUE 04/22/03 2:15P	
RPT	RPT=NONE	Displays RPT menu.
1 WEEK	RPT=1 WEEK(S) 4: TUE 04/22/03 2:15P	Sets repeat interval.
EXIT	SET:4	Returns to APPT menu Appt. 4 is "set."

Date Arithmetic (CALC)

The CALC menu performs date arithmetic:

- Determines the day of the week for any date.
- Determines the number of days between dates using one of three calendars—actual, 365-day, or 360-day.
- Adds or subtracts days from a date to determine a new date.

The calendar for date arithmetic runs from October 15, 1582 to December 31, 9999.

To display the CALC menu, press TIME, then CALC.

Table 11-4. CALC Menu Labels for Date Arithmetic

Menu Label	Description
DATE1 DATE2	Stores or calculates a date. Also displays the day of the week. If you omit the year, the calculator uses the current year.
DAYS	Stores or calculates the number of *actual* days between *DATE1* and *DATE2* , recognizing leap years.
360D	Calculates the number of days between *DATE1* and *DATE2* using the 360-day calendar (30-day months).
365D	Calculates the number of days between *DATE1* and *DATE2*, using the 365-day calendar, ignoring leap years.
TODAY	A shortcut: recalls the current date, which can then be stored in *DATE1* or *DATE2*.

The calculator retains the values for the TIME CALC variables *DATE1*, *DATE2*, *DAYS* until you clear them by pressing ◒ CLR DATA while the CALC menu is displayed.

To see what value is currently stored in a variable, press RCL menu *label*.

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:

1. Key in the first date (for today's date, use TODAY) 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, 2003 and August 2, 2040, using both the actual calendar and the 365-day calendar. Assume the date format is month/day/year.

Keys:	Display:	Description:
TIME CALC		Displays CALC menu.
4.202003		Stores Apr. 20, 2003
DATE1	DATE1= 04/20/2003 SUN	as first date and displays its day of the week.
8.022040		Stores Aug. 2, 2040 as
DATE2	DATE2 =08/02/2040 THU	second date.
DAYS	ACTUAL DAYS= 13,619.00	Calculates actual number of intervening days.
365D	365 DAYS=13,609.00	Calculates number of intervening days by a 365-day calendar.

Calculating Past or Future Dates

To calculate a date a specified number of days from another date:

1. Key in the known date (for today's date, use TODAY) and press DATE1 .

2. Key in the number of days. This number should be negative if the unknown date precedes the known date. Press DAYS .

3. Press DATE2.

This calculation always uses the actual calendar.

Example: Determining a Future Date. On February 9, 2003, you purchase a 120-day option on a piece of land. Determine the expiration date. Assume the date format is month/day/year.

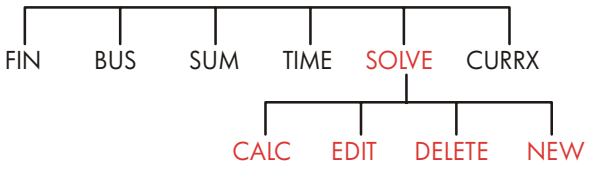
Keys:	Display:	Description:
TIME CALC		Displays CALC menu.
2.092003		Stores Feb. 9, 2003.
DATE1	DATE1= 02/09/2003 SUN	
120 DAYS	ACTUAL DAYS=120.00	Stores number of days into the future.
DATE2	DATE2= 06/09/2003 MON	Calculates expiration date (*DATE2*).

12

The Equation Solver

The Equation Solver (the SOLVE menu) stores equations that you enter and creates menus for them. You can then use those menus to do calculations. Enter Solver equations in algebraic form regardless of the calculation mode (ALG or RPN).

The Solver can store many equations—the number and length of equations is limited only by the amount of memory available. The equations are stored in a *list*.



Solver Example: Sales Forecasts

Suppose part of your job includes making sales forecasts, and that these forecasts are revised based on new information. For instance,

- A change in the price of the product will affect sales by a forecasted percentage, *A*%.
- A change in sales-force training will affect sales by a forecasted percentage, *B*%.
- A competitor's new product will affect sales by a forecasted percentage, *C*%.

Regardless of how you do this calculation (even if you do it longhand), you are using an equation:

Next Forecast = Old Forecast + Change in Old Forecast
= Old Forecast + (Projected Percentage Changes xOld Forecast)

or:

NEXT = *OLD* + ((*A*% + *B*% + *C*%) ÷ 100 x *OLD*)

Using the SOLVE and ALPHAbetic menus, you can type in this equation as

NEXT=OLD+(A%+B%+C%)÷100×OLD

and then automatically create this menu—which contains all the variables' labels—by pressing [INPUT] CALC :*

Each menu label represents a *variable*. You can use them to store and calculate values the same way you use other menus and their built-in variables.

Entering a Solver Equation. To type this equation, you must use the ALPHA menu. If you are not familiar with the ALPHAbetic menu, refer to " Typing Words and Characters " on page 30.

Keys:	Display:	Description:
SOLVE NEW	TYPE EQUATION: [INPUT]	Displays SOLVE menu, then ALPHA menu.
NEXT [=] OLD		The equation is too long

* Because the Solver uses arithmetic priority (×, ÷ before +, –), a second set of parentheses (before *A*% and after the second *OLD*) is not necessary. See "Order of Calculations," page 165.

[+] [(] A [%] [+] B [%] [+] C [%] [)] [÷] 100 [×]		for the display.
OLD	…D+(A%+B%+C%) ÷100×OLD	
[INPUT]	NEXT=OLD+ (A%+B%+C%)÷1…	Enters equation into list.
EDIT		Controls view of full equation.
-->> -->>	…D+(A%+B%+C%) ÷100×OLD	
[EXIT]	NEXT=OLD+ (A%+B%+C%)÷1…	Displays SOLVE menu.

Calculating with the Solver. Suppose last month's forecast for a product was 2,000 units. In the meantime, three market changes have occurred that affect this forecast. A) The price of the product has dropped, causing an expected 20% increase in sales. B) A major sales-force training program started, causing an expected 5% increase in sales. C) A competitor is introducing a new product, causing an expected 15% drop in sales. Calculate the new forecast for next month.

Menu Label:	Display:	Description:
CALC	VERIFYING EQUATION	Verifies that equation is valid; creates Solver menu with menu labels for this equation.
2000 OLD	OLD=2,000.00	Stores old forecast.
20 A%	A%=20.00	Stores effect of price drop on sales.
5 B%	B%=5.00	Stores effect of sales-force training on sales.

15 +/- C%	C%=-15.00	Stores effect of competitor's new product on sales.
NEXT	NEXT=2,200.00	Calculates new forecast for next month.

Suppose your boss wants next month's forecast to be 2,300 units. You can't affect *A*% or *C*%, but you can affect *B*% through the sales training program. Determine what B% must be for *NEXT* to equal 2,300 units. All you need to do is re-enter the one value you are changing:

Keys:	**Display:**	**Description:**
2300 NEXT	NEXT=2,300.00	
B%	B%=10.00	The training program would need to result in a 10% increase in sales to effect a new forecast of 2,300.

The SOLVE Menu

If the Solver list is empty, you will see an instruction for entering an equation when you press SOLVE:

If the Solver list is not empty, you will see the *current equation*—the last one entered or selected.

Pressing ▲, ▼, ▼▲, and ▼▼ moves you through the list.

Table 12-1. The SOLVE Menu Labels

Menu Label	Description
CALC	Verifies the current equation and creates menu labels for it. This is necessary before doing any calculations.
EDIT	Accesses the ALPHA-Edit menu (page 31) so you can alter the current equation. The arrow keys move long equations across the display.
DELET	Deletes the current equation or just its variables (that is, the space allotted in memory for the variables).
NEW	Allows you to enter a new equation.

While you're working with a specific equation in the Solver, the equation's own menu appears in the display. To retrieve the primary SOLVE menu, press EXIT.

Entering Equations

To make an entry into the Solver list:

1. Press SOLVE NEW. (To insert the new entry at the bottom of the list, press ▼.)
2. Use the ALPHA menu to type in characters (see page 30), and use the regular keyboard to type in digits and arithmetic operators (+, =, y^x, etc.). If you make a mistake, use ◀ to backspace or CLR to start over. Or press EXIT to bring up the ALPHA-Edit menu.
3. Press INPUT to store the equation.
4. Press CALC to verify that the equation is valid, and to create its menu labels. You now can proceed with your calculations.

When you press CALC the calculator displays:

VERIFYING EQUATION…

while the Solver checks that the equation is mathematically valid. (However, the Solver has no way of checking whether the equation is the right one for *your* problem.) If the equation cannot be solved, the calculator briefly displays:

INVALID EQUATION

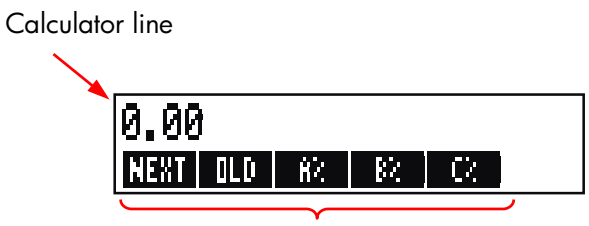
and the cursor will blink at the first character that the Solver could not interpret. (It is possible that your mistake is somewhere else, but this is a good place to start looking, since this is where the Solver got stuck.) The ALPHA-Edit menu appears so you can make changes.
Check to be sure you've made no typing mistakes, and that you've followed the rules for writing equations given on page 166 under "What Can Appear in an Equation."

An entry that is not an equation will be stored when you press INPUT , but it cannot be verified when you press CALC .

Calculating Using Solver Menus (CALC)

If pressing CALC creates a Solver menu for your equation, then the equation is good (that is, mathematically valid).

If the equation contains more than six variables, the Solver uses the label MORE to switch between sets of menu labels.



To test whether your equation is in fact correct, test it out by entering some values for which you already know the result, and see if the Solver's result is correct.

To do a calculation using a Solver menu:

1. Store values in all but one of the variables (for example, 2000 OLD, etc.). Remember that you can verify stored values by pressing RCL *menu label*.
2. To start the calculation, press the menu key for the variable you want to calculate.

In most cases, this is all you need to know about how the Solver works. However, certain types of equations are more difficult to solve.
If, during the calculation, the display temporarily shows *two* lines of changing numbers, such as

```
A:1.50000000000     -
A:1.13476129834     +
```

then the Solver is searching for a result for the variable *A*. Read the section, "How the Solver Works," starting on page 179.

Example: Return on Equity. The Return on Equity of a business can be defined as:

$$\text{ROE} = \frac{\text{Operating income} - \text{Interest} - \text{Taxes}}{\text{Common equity}}$$

Find the ROE of a small firm with $2,000 in assets. The assets earned 10% while its debt cost it 8%. The assets were financed using $500 of common equity and $1,500 of debt. The firm paid no taxes.

Operating income = assets × percentage earnings on assets
= ASSET×%ERN
Interest = debt × percentage interest paid on debt
= DEBT×%INT
Common equity = amount of common equity used for financing
= EQTY

The Solver equation would be:

```
ROE=(ASSET×%ERN÷100-DEBT×%INT÷100-TAX)÷EQTY×100
```

Keys:	Display:	Description:
MAIN		Restores MAIN menu.
SOLVE NEW	TYPE EQUATION: [INPUT]	Displays ALPHA menu.
ROE =		Entering the equation.
(ASSET ×		
% ERN		
− DEBT ×		
% INT		
− TAX)		
÷ EQTY	…−DEBT×%INT−TAX) ÷EQTY	
INPUT	ROE=(ASSET×%ERN −DEBT×…	Stores the equation.
CALC		Verifies the equation and displays the menu labels for *ROE*, *ASSET*, *%ERN*, *DEBT*, *%INT*, and (press MORE) *TAX* and *EQTY*.
2000 ASSET	ASSET=2,000.00	Stores the values for the assets, the percentage earnings on assets, the amount of debt, the percentage interest paid on the debt, the taxes paid, and the common equity.
10 %ERN	%ERN=10.00	
1500 DEBT	DEBT=1,500.00	
8 %INT	%INT=8.00	
MORE 0		
TAX	TAX=0.00	
500 EQTY	EQTY=500.00	
MORE		The return on equity is 16%.
ROE	ROE=16.00	

Editing an Equation (EDIT)

If you have an INVALID EQUATION, the cursor stops over the first character that the Solver could not logically interpret.

You can alter the current equation using the ALPHA-Edit menu:

1. Press EDIT to access the ALPHA-Edit menu. (See "Editing ALPHAbetic Text," page 31.) You can use ◀ (backspace) and CLR (clear), as well.
2. To *insert* letters, press ALPHA and the appropriate letters. Press EXIT to bring back the editing menu.
3. Press INPUT to replace the previous version with the edited version.

Editing an equation clears its variables.

To abort an editing operation without saving any of the changes, press EXIT.

Naming an Equation

Naming equations helps you identify them later. The name precedes the equation, separated by a colon. If you don't name an equation initially, you can name it later using EDIT.

Type the name just as you type the rest of the equation. The calculator knows that whatever comes before the colon is not part of the equation. The name is for your visual aid only; the calculator cannot recognize it.

Names can be any length and contain any character except + − x ÷ ( ) < > ^ : = *space*

Finding an Equation in the Solver List

To display an entry in the Solver list, display the SOLVE menu and move through the list using the ▲ and ▼ keys. ↓▲ moves to <TOP OF LIST> and ↓▼ moves to <BOTTOM OF LIST>.

Shared Variables

If two or more equations contain the same variable, that variable is *shared* among those equations. For example, suppose your Solver list of equations includes these two equations labeled RUG, which figures the cost of a carpet, and TOTAL, which figures the total cost of buying a carpet and installing it:

```
RUG: P/YD×L×W÷9=COST

TOTAL: COST+HOURS×20.50=CHARGE
```

COST is a shared variable. You can calculate a value for *COST* using the RUG equation, then switch to the TOTAL equation and calculate *CHARGE* after entering *HOURS*. Since the value for *COST* is shared, you do not need to store it again.

No sharing occurs between variables outside the Solver and those within the Solver. For example, this *COST* variable in the Solver is not shared with the *COST* variable in the MU%C and MU%P menus in BUS.

To transfer values between built-in variables and Solver variables, store them into storage registers. Recall them after switching menus. Remember that the value in the calculator line stays there when you switch menus.

Clearing Variables

You can clear the variables in a Solver equation just as you clear variables in other menus: press ↓CLR DATA while the menu with those variables is displayed.

Make sure that the *menu for the variables* is in the display. (The equation itself should *not* be in the display. If it is, press CALC .) Pressing ▬ CLR DATA now sets *NEXT*; *OLD*, *A%*, *B%*, and *C%* to zero.

Variables are also cleared when their equation is edited.

Note

If the SOLVE menu is displayed (rather than the SOLVE CALC menu), then pressing ▬ CLR DATA will prompt DELETE ALL VARIABLES?. Press NO , *otherwise you will lose the variables in all the equations*. (See "Deleting All Equations or Variables in the Solver," page 164.)

Deleting Variables and Equations

Each equation in the Solver list uses calculator memory to store 1) itself, and 2) its variables.*

Deleting a variable is quite different from *clearing* it:

- *Clearing* a variable sets it to zero; the variable retains its storage location in memory. This does not save memory space.
- *Deleting* a variable erases its value *and* its storage location. This is a way to save memory space. If a variable is shared, its value is lost to all equations that share it. The memory space for a deleted variable is re-created the next time you use that equation.

* An equation that has not been verified (CALC pressed) does not have any variables allocated to it. Therefore, it has no variables to be cleared or deleted.

Deleting One Equation or Its Variables (DELET)

To delete an equation or its variables:

1. Display the equation.
2. Press DELET in the SOLVE menu.
3. To delete the equation, respond YES to both questions:

   ```
   DELETE THE VARIABLES?
   DELETE THE EQUATION?
   ```

   (If the entry has no variables allocated, then only the second question appears.)
4. To delete just the variables, respond NO to DELETE THE EQUATION?. This preserves the equation.

Deleting All Equations or All Variables in the Solver (▼ CLR DATA)

To delete *all* the equations in the Solver, or just all the variables in all the equations:

1. Display the SOLVE menu. It doesn't matter which equation is displayed.
2. Press ▼ CLR DATA. To delete all equations, respond YES to both questions:

   ```
   DELETE ALL VARIABLES?
   DELETE ALL EQUATIONS?
   ```
3. To delete just the variables, respond NO to DELETE ALL EQUATIONS?. This preserves all equations.

Writing Equations

An equation in a book looks different from an equation in the Solver. A numerator and denominator might be separated by a bar, such as

$$\frac{a+b+c}{d-e\times f}$$

Since a Solver equation appears all on one line, you must group the numerator and denominator separately by using *parentheses*, such as

```
(A+B+C)÷(D−E×F)
```

Order of Calculations. Operations occur from left to right *but* do:

- **Exponentiation first.** For example, `A×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 equation as `(A×B)^3=C`.
- **Multiplication and division before addition and subtraction.** For example, `A+B÷C=12` is interpreted as $A + (B/C) = 12$. To divide the sum of $A + B$ by *C*, enter the equation as `(A+B)÷C=12`.

Parentheses. Parentheses override the above rules of priority. *When in doubt, use parentheses.* It never hurts to use parentheses—even multiple parentheses. (Do not use brackets or braces.)

For example, earlier (page 154) we used the equation

$$\text{Next Forecast} = \text{Old Forecast} + \left(\frac{(A\% + B\% + C\%) \times \text{Old Forecast}}{100}\right),$$

which was entered into the calculator as

```
NEXT=OLD+(A%+B%+C%)÷100×OLD.
```

$\frac{A}{B \times C}$ would be entered as `A÷(B×C).`

$A + \frac{B \times C}{D \times E}$ could be entered as `A+B×C÷(D×E).`

$A + \frac{B \times C}{(D+5) \times E}$ could be entered as `A+B×C÷((D+5)×E)`.

What Can Appear in an Equation

Long Equations. There is no limit on the length of an equation (or the number of variables it has) if there is enough memory to store it. An equation longer than one display line (22 characters) moves to the left and adds an ellipsis (...).

To view a long equation, move the cursor using the arrow keys on the ALPHA-Edit menu. For example:

```
TOTALCOST=LENGTH×WIDTH×HEIGHT÷12×UNIT×(1+MARKUP%÷100)
```

looks like

```
TOTALCOST=LENGTH×WIDT…
```

when it is stored. Press EDIT -->> -->> to view successive portions of the equation:

```
…H×HEIGHT÷12×UNIT×(1+…
```

Spaces. You can use as many spaces as you like *between* variables, operators, and numbers.

Names of Variables. A variable's name can be up to 10 characters long, but cannot contain the characters + − x ÷ ^ ( ) < > = : *space*

The first three to five characters (depending on their widths) become the variable's menu label. Therefore, make sure no two variables in the same equation have the same first three to five characters.

Do not use AND, NOT, OR, XOR, or PI as variable names because they will be interpreted as functions.

Numbers (Constants). Do not put commas or other characters in numbers. For instance, type `10000` for ten thousand (*not* `$10,000`).

Parentheses. Do not use brackets or braces. Parentheses determine order, but do *not* imply multiplication. For example, the equation $P_{sn} = P_s\,(1-F)$ would be typed into the Solver as `PSN=PS×(1-F)`. The × sign must be inserted between `PS` and the parenthesis.

Functions and Conditional Expressions. An equation can contain any of the functions and conditional expressions given in the table on pages 168-171. Some of these functions also have *typing aids*.

Math Operators ("Typing Aids"). All of the math operators are located either on the keyboard (÷, ▼ 1/x, etc.) or in the MATH menu (LN , EXP , etc.). Any of these operators *except* % can be included in an equation. (In the Solver, % is just a character.) You can call up the MATH menu from the Solver.

Many of these operators look different in an equation: pressing ▼ √x produces `SQRT(` , for example. You then supply a number or variable followed by a closing parenthesis. The list of Solver functions on pages 168-171 shows the spelling of each function. Note that you supply the number *after* supplying the function.

You can also type these functions letter by letter using the ALPHA menu. However, it is faster to select math operators directly on the keyboard or in the MATH menu. This is called a *typing aid*.

For instance, these two methods of placing 25! (factorial) into an equation are equivalent. Starting after SOLVE NEW :

1. Using the ALPHA Menu

Keys:	Display:	Description:
FGHI		
F	F	
ABCDE		
A	FA	

ABCDE		
C	FAC	
RSTUV		
T	FACT	
(25) =	FACT(25)=	
ABCDE		This calculates 25!
A	FACT(25)=A	(factorial).

2. Using a Typing Aid

Keys:	Display:	Description:
MATH		MATH menu labels appear.
N!	FACT(	The ALPHA menu automatically returns after one MATH selection.
25) =	FACT(25)=	
ABCDE		This also calculates 25!,
A	FACT(25)=A	and with fewer keystrokes.

Solver Functions

Here is a complete list of functions that you can include in Solver equations. The items inside parentheses must be replaced by specific numbers, variables, or algebraic expressions.

In addition, you can use the arithmetic operators (+, −, x, ÷, y^x), *but not* %. (In the Solver, % is just a character, not an operator.)

Table 12-2. Solver Functions for Equations

Function	Description
ABS(*x*)	Absolute value of *x*.
ALOG(*x*)	Common (base 10) antilogarithm; 10^x.
CDATE	Current date.
CTIME	Current time.
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:cal*)	Number of days between dates *d1* and *d2*. Formats for *d1* and *d2* are set in the TIME menu; cal designates the calendar: ■ *cal* = 1 for the actual calendar, which recognizes leap years. ■ *cal* = 2 for the 365-day calendar, which ignores leap years. ■ *cal* = 3 for the 360-day calendar, which uses 12, 30-day months.
EXP(*x*)	Natural antilogarithm; e^x.
EXPM1(*x*)	$e^x - 1$.
FACT(x)	*x*!; factorial of a positive integer.
FLOW(CFLO-listname:flow#)	Value of the specified cash flow.
FP(*x*)	Fractional part of *x*.

Table 12-2. Solver Functions for Equations (Continued)

Function	Description
HMS(*time*)	Converts time in decimal hours to *HH.MMSS* format.
HRS(*time*)	Converts time in *HH.MMSS* format to decimal hours.
IDIV(*x*:*y*)	Integer part of the quotient of x/y.
IF(*cond*:*expr*$_1$:*expr*$_2$)	Conditional expression: if cond is true, use expr$_1$; if cond is false, use expr$_2$. See page 174.
INT(*x*)	Greatest integer less than or equal to *x*.
INV(*x*)	Inverse of x; 1/x.
IP(*x*)	Integer part of x.
ITEM(*SUM-listname:item#*)	Value of the specified SUM-list item.
LN(*x*)	Natural (base e) log of x.
LNP1(*x*)	ln (1 + x)
LOG(*x*)	Common (base 10) log of x.
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*)	Remainder of the division x/y. MOD(x,y) = x−y x INT(x/y)
PI	π ; 3.14159265359 (12 digits).
RND(*x*:*y*)	Rounds *x* to *y* decimal places if $0 \le y \le 11$, or rounds *x* to *y* significant digits if $-12 \le y \le -1$. *y* must be an integer.
S(*variable name*)	Used in an IF function to test if *solving for* the variable named. Used to combine related equations into one Solver menu. See page 178.
SGN(*x*)	Sign of *x* (+1 if $x > 0$, 0 if $x=0$, −1 if $x < 0$.

Table 12-2. Solver Functions for Equations (Continued)

Function	Description
Σ(*cfr*:c_1:c_2:*s*:*expr*)	Summation of the algebraic expression *expr* for values of the counter *ctr*, stepping from c_1 to c_2 at increments of *s*. See page 176.
SIZEC(*CFLO-listname*)	The number of the last flow in specified CFLO list.
SIZES(*SUM-listname*)	The number of items in specified SUM list.
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 ÷ SPFV(i%:n). n is the number of compounding periods. i% is the interest rate per compounding period, expressed as a percentage.
SQ(*x*)	Square of *x* ; x^2.
SQRT(*x*)	Square root of *x* ; $\sqrt{X}$.
#T(*CFLO-listname*:*flow#*)	The number of times that specified cash flow occurs.
TRN(*x*:*y*)	Truncates *x* to *y* decimal places if $0 \leq y \leq 11$, or truncates *x* to *y* significant digits if $-12 \leq y \leq -1$. *y* must be an integer.
USFV(*i%*:*n*)	Future value of a uniform series of $1.00 payments; equivalent to (SPFV(*i%*:*n*)−1) ÷ (*i%* ÷100). *n* is number of payments. *i%* is 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*) ÷ SPFV(*i%*:*n*). *n* is number of payments. *i%* is periodic interest rate, expressed as a percentage.

Example Using a Solver Function (USPV): Calculations for a Loan with an Odd First Period. Suppose an auto purchase is financed with a $6,000 loan at 13.5% annual interest. There are 36 monthly payments starting in one month and five days. What is the payment amount**?**

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

The formula for this loan is:

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

where:

ANNI= the annual percentage interest rate.
N= the number of payment periods.
DAYS= the number of leftover, odd days (an integer from 0 through 30).
PV= the amount of the loan.
PMT= the monthly payment.

The formula can be rearranged and simplified using USPV, the Solver function for returning the present value of a uniform series of payments:

```
PV×(1+ANNI÷1200×DAYS÷30)+
  PMT×USPV(ANNI÷12:N)=0
```

The keystrokes are:

PV [×] [(] 1 [+] ANNI [÷] 1200 [×] DAYS [÷] 30 [)]
[+] PMT [×] USPV [(] ANNI [÷] 12:N [)] [=] 0

Keys:	Display:	Description:
SOLVE ▼	<BOTTOM OF LIST>	Displays SOLVE menu and bottom of Solver list.
NEW	TYPE EQUATION; [INPUT]	Displays ALPHA menu.
(type in equation as shown above)	...MT×USPV(ANNI÷12:N)=0	Remember that the colon is located after. OTHER (Press WXYZ OTHER :)
INPUT CALC	0.00	Enters equation, verifies it, and creates menu.
6000 PV	PV=6,000.00	Stores loan amount in *PV*.
13.5 ANNI	ANNI=13.50	Stores annual percent interest in *ANNI*.
5 DAYS	DAYS=5.00	Stores number of odd days in *DAYS*.
36 N	N=36.00	Stores number of payments in *N*.
PMT	PMT=-203.99	Calculates monthly *PMT* of $203.99.

Conditional Expressions with IF

Equations can include conditional expressions using the function IF. The syntax of the IF function is:

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

then *or else*

For example, the solver accepts the equation:

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

According to this equation, if *SALES* is greater than 3000, then the *BONUS* equals .02 × *SALES*; otherwise ("or else"), *BONUS* equals .01 × *SALES*.

Logical Operators. Four logical operators can be used in conditional expressions: AND, OR, XOR, and NOT.

Relational Operators. Six relational operators are available for conditional expressions.

Operator	Keys
>	> (ALPHA menu)
<	< (ALPHA menu)
=	=
≥	> =
≤	< =
≠	< >

* A *conditional expression* that contains within it an algebraic expression might cause the error `INVALID EQUATION`. If this happens, insert a + before the left parenthesis starting the algebraic expression. For example, change
`IF((A+2)÷5<12:...` to
`IF(+(A+2)÷5<12:...`.

Examples of Conditional Equations.

- `B = IF (A>7 AND A<=15:2×A÷6:3×A+10)+C`
  Means: If A is greater than 7 and is less than or equal to 15, then $B = 2 \times A \div 6 + C$. Otherwise, $B = 3 \times A + 10 + C$.
- `VALUE = FIRST+IF(NOT(FIRST=0):1÷FIRST:0)`
  Means: If *FIRST* is not equal to 0, then
  $VALUE = FIRST + 1 \div FIRST$. If $FIRST = 0$, then $VALUE = FIRST$.
- `T = W ×IF(A=0 XOR B=0:A+B:A×B)`
  Means: If *A* or *B*, but not both, equals 0, then $T = W \times (A + B)$.
  Otherwise, $T = W \times A \times B$. In other words,
  When $A = 0$ and $B \neq 0$, $T = W \times B$.
  When $A \neq 0$ and $B = 0$, $T = W \times A$
  When $A = 0$ and $B = 0$, $T = 0$.
  When $A \neq 0$ and $B \neq 0$, $T = W \times A \times B$.

Example: Nested IF Functions. An IF function can be used as the argument of another IF function. This is called *nesting*. Suppose a corporation uses a rating system to determine salary. Employees are rated on a scale from 1 through 3, and are given the following annual percent raise based on their rating:

Rating	Percent Salary Increase
1	3%
2	6%
3	10%

The Solver equation to calculate an employee's new salary is based on his or her rating and old salary. What would be the new annual salary for an employee with a rating of 2 who currently earns $27,500 annually**?**

Press SOLVE NEW, then enter the equation:

```
NEW=OLD × (1+IF(R=1:.03:IF(R=2:.06:.1)))
```

To do the calculation:

Keys:	Display:	Description:
INPUT CALC		Stores, verifies, and creates menu labels for the equation.
27500 OLD	OLD=27,500.00	Stores old salary.
2 R	R=2.00	Stores rating.
NEW	NEW=29,150.00	Calculates new salary.

The Summation Function (Σ)

The Σ function does summation calculations in an equation:

Σ(*counter variable* : *starting value* : *ending value* : *step size* : *algebraic expression*)

The *counter variable* takes on a series of values, beginning with the *starting value*, and incrementing according to the *step size*, until it passes the *ending value*. For each value of the counter, the *algebraic expression* is evaluated, and the value is added to the previous value. The Σ function returns the final summation.

For example, when the equation:

```
SERIES=Σ(I:1:6:1:I×X^I)
```

is solved for *SERIES*, the counter *I* runs from 1 through 6 in steps of one —that is, 1, 2, 3, 4, 5, 6. For each value *I*, the expression `I×X^I` is

calculated and added to the sum. Thus the stored value of X is used to calculate $X + 2X^2 + 3X^3 + 4X^4 + 5X^5 + 6X^6$.

The following equation uses a variable as the ending value, 0 as the beginning value, and a step size of 2.

```
SERIES=Σ(I:0:LAST:2:I×X^I)
```

If 8 is stored in *LAST*, *I* takes on values of 0, 2, 4, 6, and 8. Then the stored value of *X* will calculate $2X^2 + 4X^4 + 6X^6 + 8X^8$.

Accessing CFLO and SUM Lists from the Solver

You can use a Solver equation to perform calculations other than those in the CFLO and SUM menus using data stored in CFLO and SUM lists. The following Solver functions gain access to these lists.

- `SIZEC(`*CFLO-listname*`)` returns the number of the last flow in the specified CFLO list. For example, if the last flow in the list INV were `FLOW(6)=5,000.00`, then `SIZEC(INV)` would equal 6.00.
- `FLOW(`*CFLO-listname* `:` *flow number*`)` returns the value of the specified flow.
- `#T(`*CFLO-listname* `:` *flow number*`)` returns the number of times the specified flow occurs.
- `SIZES(`*SUM-listname*`)` returns the number of items in the specified SUM list.
- `ITEM(`*SUM-listname* `:` *item number*`)` returns the value of the specified item.

Summation of List Data. The Σ function can be used to sum calculations done with numbers in lists. For example, the following equation calculates $\Sigma x_i^2 y_i^2$ for values stored in two SUM lists named XVAR and YVAR, which must have the same number of items:

```
SX2Y2=Σ(I:1:SIZES(XVAR):1:ITEM(XVAR:I)^2×
                ITEM(YVAR:I)^2)
```

"Chi-Squared Statistics" in chapter 14 illustrates another use of the Σ function with SUM lists.

Creating Menus for Multiple Equations (S Function)

The S (*solving for*) function is used in conjunction with the IF function to group related equations together and to specify the criteria for choosing one of them to solve.

S(*variable name*)

The advantage over two separate equations is that the single equation gives you a single menu with all possible variables. That way, if you are working with two different but related problems, you can keep the same Solver menu labels in the display all the time—you don't have to switch equations.

For example, consider these two equations for conversions:

`KG×2.21=LB` and `M×3.28=FT`

The following, rearranged single equation can do either conversion:

```
IF(S(KG) OR S(LB):KG×2.21-LB:M×3.28-FT)=0
```

This means: if you are *solving for* either *KG* or *LB*, then use $KG \times 2.21 - LB = 0$. Otherwise (that is, if you are solving for *M* or *FT*), use $M \times 3.28 - FT = 0$. The two conversion equations are rewritten so that all the variables appear on one side of each equation, and the other side is set equal to zero.

The S function appears as part of the conditional expression of the IF function. You can leave out the "=0" and it will be understood that the whole equation is set equal to zero.

Example: Unit Conversions. Use the above equation to convert between kilograms and pounds and between meters and feet.

Press SOLVE NEW then enter the equation:

```
IF(S(KG) OR S(LB):KG×2.21-LB:M×3.28-FT)
```

Press INPUT to store it, then CALC to verify it and create its menu:

1. Convert 225 pounds to kilograms.
Press 225 LB KG Result is KG=101.81.

2. How many feet equal 100 meters?
Press 100 M FT Result is FT=328.00.

Note that you do not have to clear variables between steps 1 and 2. The S function considers only those values in the part of the equation that it is solving.

How the Solver Works

The Solver has two ways of finding an answer. First, it tries to find a *direct* solution by rearranging the equation and then solving for the variable. If the Solver finds a direct solution, the calculator displays the result.

If the Solver is unable to find a direct solution, it tries to find the answer indirectly by *iteration*. It estimates a set of answers, sees how close they are to a solution, and then makes another set of estimates. The calculator displays the Solver's current estimates as the Solver searches for an answer. You should keep in mind that *there might be more than one solution to an equation*, and that it might be necessary for you to enter guesses 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 can stop this iterative process, enter your own guesses, and restart the search. (See "Halting and Restarting the Iterative Search" and "Entering Guesses," below.)

The process of finding a solution iteratively is very complex. There are four possible outcomes. Refer to "Solver Calculations" in appendix B for additional descriptions of these outcomes.

- **Case 1:** The calculator displays a result. It is very likely that this is a solution to the equation. To check how good this result is, you can repeat the calculation by pressing the menu key for the variable you solved for. If the two sides of the equation have not been calculated to be exactly equal, the calculator displays a message with the values for the left and right sides of the equation. Read "Solver Calculations" in appendix B for an explanation of the meaning of this display.
- **Case 2:** The calculator displays a message with the calculated, unequal values of the left and right sides of the equation. The Solver has found a possible solution, but you must interpret its validity. To see the questionable solution, press ◀ or CLR. Refer to "Solver Calculations" in appendix B for more information.
- **Case 3:** The calculator displays `BAD GUESSES: PRESS [CLR] TO VIEW`. The Solver cannot begin the search with the current guesses. Press ◀ or CLR to view the starting guesses. To supply new guesses, see "Entering Guesses," below.
- **Case 4:** The calculator displays `SOLUTION NOT FOUND`. Check to see if your equation and stored values are correct. If the equation is correct, you might be able to find a solution by entering very good guesses.

Halting and Restarting the Iterative Search

When the Solver is iteratively searching for a solution (in other words, when the Solver is displaying sets of estimates), you can halt the calculation by pressing any key except ON. The calculator displays the message `INTERRUPTED`. To see the best estimate the Solver has found so far, press CLR or ◀. 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 (see "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. Second, if more than one solution exists, entering guesses may lead the Solver to a solution in a specified range. The closer your guesses are to the desired solution, 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 iterative search.
- After the Solver has returned an answer, and you wish to begin searching for another answer.

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 uses those two guesses to start searching for a solution. 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 Solver variable named *A* and starts the calculation.

To enter two guesses, key in the first guess and press the menu key. Then 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 using 0 and 100.

Example: Using Guesses to Find a Solution Iteratively. One equation for calculating the profit from a manufacturing operation is:

$$\text{Profit} = (\text{Price} \times \text{Quantity}) - (\text{Variable costs} \times \text{Quantity}) - \text{Fixed Costs}$$

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.)

Press SOLVE NEW , then enter the equation:

PROFIT=PRICE × QTY−VARCOST × QTY−FIXCOST

Keys:	**Display:**	**Description:**
INPUT CALC		Stores, verifies, and creates labels for the equation.
6000 PRICE	PRICE=6,000.00	Stores price.
4100 VARCO	VARCOST=4,100.00	Stores variable cost,
112000 FIXCO	FIXCOST=112,000.00	fixed cost, and profit.
130000 PROFI	PROFIT=130,000.00	

The following steps enter guesses for *QTY*. If the Solver must search iteratively to solve for *QTY*, it will begin by using the estimates 100 and 200.

Keys:	**Display:**	**Description:**
100 QTY	QTY=100.00	The first guess for *QTY*.
200 QTY	QTY=200.00	The second guess for *QTY*.

QTY

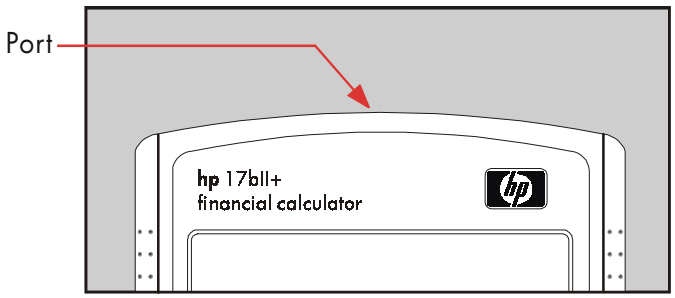
```
QTY:200.000000000-
QTY:100.000000000+
.
.
.
QTY=127.37
```

Solves for *QTY* iteratively.

13

Printing

The calculator can print information using the hp 82240 Infrared Printer, which accepts the infrared signal from the printer port. This chapter describes information you can print. Operation of the printer is covered in the printer owner's manual.*



The print annunciator ( )appears in the display whenever the calculator sends information through its printer port.

Because communication goes only one way—from calculator to printer—the calculator cannot determine whether the printer is receiving information. If a printing operation involves many lines of information, the calculator slows its transmission rate to allow the printer time to print.

To preserve battery power, the calculator will not transmit data to the printer when the low-power annunciator ( ) is on. If a low-power condition occurs after you've started a printing operation, printing stops and the calculator displays the message BATT TOO LOW TO PRINT.

* Since the hp-17bII+ cannot send control characters to the printer, portions of the printer's manual pertaining to control codes and graphics characters do not apply.

The Printer's Power Source

The speed of the printer depends on whether it is using its optional ac adapter. To optimize printing performance, set the printing speed mode in the calculator appropriately. To view or change the printing speed mode:

1. Press ▬ MODES.
2. Press PRNT to change and display the new mode. If necessary, press PRNT again to set the desired mode:
   - PRINTER: AC ADAPTER
   - PRINTER: NO AC ADAPTER
3. Press EXIT.

For long printing operations, printing will be faster using the printer's ac adapter and the calculator's appropriate printing speed mode. When the printer is powered by batteries alone, be sure to change the mode to PRINTER: NO AC ADAPTER so that the calculator will not transmit data too rapidly.

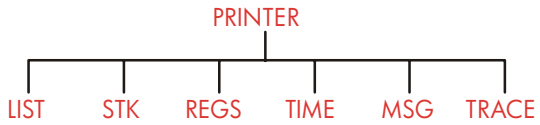
Double — Space Printing

Press ▬ MODES DBL to turn double-space printing on or off. Then press EXIT.

Printing the Display(PRT)

To print whatever is in the calculator line, press PRT. This prints numbers, expressions, single Solver equations, and messages. Menus cannot be printed.

Printing Other Information (▬ PRINTER)



The PRINTER menu provides the ability to print most of the information you've stored, including the contents of variables, lists, appointments, the history stack, registers, and the current date and time. You can also transmit descriptive notes to label the output. (To print amortization schedules, see "Printing an Amortization Table," page 81.)

From within any menu you can press ▬ PRINTER to bring up the PRINTER menu. This table summarizes those printing activities.

Table 13-1. The PRINTER Menu Labels

Menu Label	Description
LIST	Prints data stored or calculated in the current menu. See "Printing Variables and Lists," below.
STK	Prints the contents of the history stack.
REGS	Prints the contents of registers 0 through 9.
TIME	Prints the current date and time.
MSG	Displays the ALPHA menu for typing a message up to 22 characters long. See page 188.
TRACE	Switches between Trace On and Trace Off modes. See "Trace Printing," page 188.

Upon completion, all of these functions except TRACE return the previous menu to the display.

Printing Variables, Lists, and Appointments (LIST)

You can list specific sets of information stored in menus by pressing ▬ PRINTER LIST while the relevant menu labels are displayed.

Printing the Values Stored in Variables. You can print a listing giving the values of all variables whose menu labels are displayed.*
For example, if the calculator is in the FIN TVM menu, it displays the labels N I%YR PV PMT FV OTHER.

Pressing PRINTER LIST now produces a print-out like this:

```
N=              360.00
I%YR=            12.50
PV=          65,000.00
PMT=           -693.00
FV=               8.00
P/YR=            12.00
END MODE
```

Printing Number Lists. To print out the contents of a particular SUM or CFLO list, that list must be the *current* list. Pressing PRINTER LIST while a SUM list named SALES is the current list produces labeled output like this:

```
NAME: SALES

ITEM#            VALUE

1              1,400.00
2                920.00
3              1,100.00
4              2,265.00
TOTAL=         5,685.00
```

Printing Solver Equations. To print one or all Solver equations, display the main SOLVE menu (press SOLVE).

- To print just the current equation, press PRT.
- To print out the entire list of equations, press PRINTER LIST.

* Except *IRR%*. Instead, press IRR% PRT to print the value for *IRR%*.

Printing Appointments. To print all stored appointments, display the APPT menu (press APPT then press PRINTER LIST. This produces a listing like this for each appointment:

```
1: WED 07/23/03 10:00A
DEMO FOR SMITH
RPT=NONE
```

Menus Not Associated with Stored Data. Remember that many menu labels do not represent data, but rather activities, such as FIN, BUS, DELET and SET. They contain no information for printing. The calculator beeps if there is nothing to print when you press PRINTER LIST.

Printing Descriptive Messages (MSG)

You can include descriptive messages with your printed output by using MSG. For example, suppose you wanted to print a number that represents the balance for September. You could start the output with the label "SEPTEMBER BALANCE".

1. Press PRINTER, then MSG. This brings up the ALPHA menu.
2. Type (and edit) the label or message.
3. Press INPUT to print out the label or message.

Now print out the number itself (if it's in the calculator line, press PRT).

Trace Printing (TRACE)

Trace printing produces a record of all the keys you've pressed and of calculated results. When tracing is *off*, use PRT and PRINTER to print what you want. When tracing is on, the calculator uses more power and operates more slowly.

To switch trace printing on and off:

1. Press PRINTER.

2. Press TRACE to change the setting. A message informs you that tracing is on or off. If necessary, press TRACE again to display the desired message.

3. Press EXIT.

Example: Trace-Printing an Arithmetic Calculation. Produce a record of the keystrokes you use to do the following calculation and store the result in the TVM variable *PMT*.

$$^{1}/_{12} \times 4{,}800 + 125$$

Press PRINTER TRACE to set `PRINT MODE: TRACE ON`. If you see `PRINT MODE: TRACE OFF`, press TRACE again.

Keys:	Print-out:	
EXIT		EXIT
FIN		FIN
TVM		TVM
12 1/x	12.00	1/X
	0.08	***
✓ ×		×
✓ 4800 +	4,800.00	+
✓ 125 =	125.00	=
	525.00	***
PMT		PMT
PRINTER		PRINTER
TRACE		TRACE
EXIT		

How to Interrupt the Printer

Pressing a calculator key during a printing operation will interrupt transmission, but not immediately stop the printing.

To stop the printer immediately, turn it off.

14

Additional Examples

Loans

Simple Annual Interest

See appendix F for RPN keystrokes for this example.

Example: Simple Interest at an Annual Rate. Your good friend needs a loan to start her latest enterprise and has requested that you lend her $450 for 60 days. You lend her the money at 7% simple annual interest, to be calculated on a 365-day basis. How much interest will she owe you in 60 days, and what is the total amount owed**?**

$$\text{The interest is: (7\% of \$450)} \times \frac{60 \text{ days}}{365 \text{ days}}$$

✓ **Keys:**	**Display:**	**Description:**
450 [×] 7 [%]	450.00 ×0.07	Annual interest.
[×] 60 [÷] 365		Actual interest for 60
[+]	5.18+	days.
450 [=]	455.18	Add principal to get total debt

A Solver Equation for Simple Annual Interest:

```
DEBT=LOAN+LOAN×I%÷100×DAYS÷365
```

DEBT = the total owed at the end of the loan period.
LOAN = the original amount (principal) lent.
I% = the annual interest rate as a percent.
DAYS = the number of days in the loan.

For instructions on entering Solver equations, see "Solving Your Own Equations," on page 29.

If you know the dates for the course of the loan, rather than the number of days, use this for an actual-calendar basis:

```
DEBT=LOAN+LOAN×I%÷100×DDAYS(DATE1:DATE2:1)÷365
```

or use this for a 360-day basis:

```
DEBT=LOAN+LOAN×I%÷100×DDAYS(DATE1:DATE2:3)÷360
```

DATE1 = the date the loan commences.
DATE2 = the date the loan ends.

Yield of a Discounted (or Premium) Mortgage

The annual yield of a mortgage bought at a discount or premium can be calculated given the original mortgage amount (*PV*), interest rate (*I%YR*), periodic payment (*PMT*), balloon payment amount (if any) (*FV*), and the price paid for the mortgage (new *PV*).

Remember the cash-flow sign convention: money paid out is negative, money received is positive.

Example: Discounted Mortgage. An investor wishes to purchase a $100,000 mortgage taken out at 9% for 20 years. Since the mortgage was issued, 42 monthly payments have been made. The loan is to be paid in full (a *balloon payment*) at the end of its fifth year. What is the yield if the purchase price of the mortgage is $79,000**?**

1. Since the payment amount (*PMT*) is not given, calculate it first. To do this, first assume 20 years' amortization on the original mortgage with no balloon payment (so $N = 20 \times 12$, $FV = 0$, $PV = -100{,}000$, and $I\%YR = 9$).
2. Since the balloon amount is not given, calculate it (*FV*) next. Use *PMT* from step 1, but change *N* to 5 years ($N = 5 \times 12$).

3. Finally enter current values for *N* (less number of payment periods already passed, or 5 × 12 − 42) and *PV* (proposed purchase price, $79,000); then calculate *I%YR* for the annual yield.

Step 1: Calculate *PMT*. Make sure *FV* = 0.

Keys:	Display:	Description:
FIN TVM OTHER		Selects menu; sets 12 payments per year and End mode.
▼ CLR DATA		
EXIT	12 P/YR END MODE	
20 ▼ N	N=240.00	Figures and stores *total* number of payments for a full 20-year loan with monthly payments.
9 I%YR		Stores interest rate and amount of original loan. (Money paid out is negative.)
100000 +/−		
PV	PV=-100,000.00	
0 FV	FV=0.00	Sets *FV* to zero.
PMT	PMT=899.73	Calculates monthly payment received.

Step 2: Enter the new value for *N* given a balloon in 5 years, then find *FV*, the amount of the balloon.

Keys:	Display:	Description:
5 ▼ N	N=60.00	Stores number of payments for 5 years.
FV	FV=88,707.05	Calculates balloon due in 5 years.

Step 3: Enter actual, current values for *N* and *PV*; then find new *I%YR* for discounted mortgage with balloon.

Keys:	Display:	Description:
RCL N		Stores number of payments remaining in 5-year loan.
✓ − 42 N	N=18.00	
79000 +/− PV	PV=-79,000	Stores proposed, discounted purchase price (new present value).
I%YR	I%YR=20.72	Calculates percent annual yield.

Annual Percentage Rate for a Loan with Fees

See appendix F for RPN keystrokes for the next two examples.

The *annual percentage rate*, APR, incorporates fees usually charged when a mortgage is issued, which effectively raises the interest rate. The actual amount received (the *PV*) by the borrower is reduced, while the periodic payments remain the same. The APR can be calculated given the term of the mortgage (*N* periods), the annual interest rate (*I%YR*), the mortgage amount (new *PV*), and the basis of the fee charged (how the fee is calculated).

Remember the cash-flow sign convention: money paid out is negative, money received is positive.

Example: APR for a Loan with Fees. A borrower is charged two points for the issuance of a mortgage. (One point is equal to 1% of the mortgage amount.) If the mortgage amount is $60,000 for 30 years and the interest rate is 11½% annually with monthly payments, what APR is the borrower paying?

1. Since the payment amount is not given, calculate it (*PMT*) first. Use the given mortgage amount (*PV* = $60,000) and interest rate (*I%YR* = $11\frac{1}{2}\%$).
2. To find the APR (the new *I%YR*), use the *PMT* calculated in step 1 and adjust the mortgage amount to reflect the points paid (PV = $60,000 − 2%). All other values remain the same (term is 30 years; no future value).

Keys:	Display:	Description:
FIN TVM OTHER ▼ CLR DATA EXIT	12 P/YR END MODE	If necessary, sets 12 payments per year and End mode.
30 ▼ N	N=360.00	Figures and stores number of payments.
11.5 I%YR		Stores interest rate and
60000 PV	PV=60,000.00	amount of loan.
0 FV	FV=0.00	No balloon payment, so future value is zero.
PMT	PMT=−594.17	Borrower's monthly payment.
RCL PV ✓ − 2 %		Stores actual amount of money received by
PV	PV=58,800.00	borrower into *PV*.
I%YR	I%YR=11.76	Calculates APR.

Example: Loan from the Lender's Point of View. A $1,000,000, 10-year, 12% (annual interest) interest-only loan has an origination fee of 3 points. What is the yield to the lender**?** Assume that monthly payments of interest are made. (Before figuring the yield, you must

calculate the monthly *PMT* = (*loan* x 12%) ÷ 12 mos.) When calculating the *I%YR*, the *FV* (a balloon payment) is the entire loan amount, or $1,000,000, while the *PV* is the loan amount minus the points.

Keys:	Display:	Description:
FIN TVM OTHER		If necessary, sets 12 payments per year and End mode.
CLR DATA EXIT	12 P/YR END MODE	
10 N	N=120.00	Stores total number of payments.
✓1000000 ×		Calculates annual interest on $1,000,000 ...
✓12 % ÷	120,000.00÷	
12 PMT	PMT=10,000.00	...and calculates, then stores monthly payment.
1000000 FV	FV=1,000,000.00	Stores entire loan amount as balloon payment.
✓− 3 % =		Calculates, then stores
+/− PV	PV=−970,000.00	amount borrowed (total — points).
I%YR	I%YR=12.53	Calculates APR—the yield to lender.

Loan with an Odd (Partial) First Period

The TVM menu deals with financial transactions in which each payment period is the same length. However, situations exist in which the first payment period is not the same length as the remaining periods. This first period is sometimes called an *odd* or *partial first period*.

The following Solver equation calculates *N*, *I%*, *PV*, *PMT*, or *FV* for transactions involving an odd first period, using simple interest for the odd period. The formula is valid for 0 to 59 days from inception to

first payment, and a 30-day month is assumed.*

A Solver Equation for Odd-Period Calculations:

```
ODD: PV×(I%÷100×FP(DAYS÷30)+1)=-IF(DAYS<30:
(1+I%÷100)×PMT:PMT)×USPV(I%:N)-FV×SPPV(I%:N)
```

(For the < character, press WXYZ OTHER < .)

PV = the loan amount.
I% = the periodic interest rate.
DAYS = the actual number of days until the first payment is made.
PMT = the periodic payment.
N = the total number of payment periods.
FV = the balloon payment. A balloon payment occurs at the end of the last (*N*th) period and is in addition to any periodic payment.

The following examples assume that you have entered the equation named ODD, above, into the Solver. For instructions on entering Solver equations, see "Solving Your Own Equations," on page 29.

Example: Loan with an Odd First Period. A 36-month loan for $4,500 has an annual interest rate of 15%. If the first payment is made in 46 days, what is the monthly payment amount**?**

Select equation ODD in the Solver.

Keys:	**Display:**	**Description:**
CALC		Creates menu.
36 N	N=36.00	36 payment periods.
4500 PV	PV=4,500.00	Stores loan amount.
✓15 ÷ 12		Stores *periodic*, monthly

* You do not need to specify Begin or End mode. If the number of days until the first payment is less than 30, Begin mode is assumed. If the number of days until the first payment is between 30 and 59, inclusive, End mode is assumed.

I%	I%=1.25	interest rate.
46 DAYS	DAYS=46.00	Stores days until first payment.
0 FV	FV=0.00	No balloon payment.
PMT	PMT=-157.03	Calculates payment.

Example: Loan with an Odd First Period Plus Balloon. A $10,000 loan has 24 monthly payments of $400, plus a balloon payment of $3,000 at the end of the 24th month. If the payments begin in 8 days, what annual interest rate is being charged**?**

Select equation ODD.

Keys:	**Display:**	**Description:**
CALC		Creates menu.
10000 PV	PV=10,000.00	Stores known values.
24 N	N=24.00	
400 +/- PMT	PMT=-400.00	
3000 +/-		
FV 8 DAYS	FV=-3,000.00	
	DAYS=8.00	
I%	I%=1.64	Calculates *periodic* (monthly) interest rate.
✓ × 12 =	19.67	Annual interest rate.

Canadian Mortgages

In Canadian mortgages, the compounding and payment periods are not the same. Interest is compounded semi-annually while payments are made monthly. To use the TVM menu in the hp 17bII+, you need to calculate a *Canadian mortgage factor* to store as *I%YR*.

1. Set End mode and store 12 P/YR .

2. Store 0 PMT, 6 N, and 200 PV.

3. Add 200 to the annual interest rate, make the number negative, and store it in FV.

4. Press I%YR to calculate the Canadian mortgage factor.

5. Continue the problem by supplying the other mortgage values and solving for the unknown item. *Do not change I%YR from step 4.*

Example: Canadian Mortgage. What is the monthly payment required to fully amortize a 30-year, $30,000 Canadian mortgage if the interest rate is 12%?

Keys:	Display:	Description:
FIN TVM		Displays TVM menu; sets
OTHER ↓ CLR DATA		12 payments per year
EXIT	12 P/YR END MODE	with End mode.
0 PMT	PMT=0.00	
6 N	N=6.00	
200 PV	PV=200.00	
✓ + 12 = +/-		
FV	FV=-212.00	
I%YR	I%YR=11.71	Calculates *I%YR* for Canadian mortgage factor.
30 ↓ N	N=360.00	Stores other values.
30000 PV	PV=30,000.00	
0 FV	FV=0.00	
PMT	PMT=-301.92	Monthly payment.

A Solver Equation for Canadian Mortgages:

```
CAN: PV=-PMT×USPV(((1+I%YR÷200)^(1÷6)-1)×100:N)
     -FV×SPPV(((1+I%YR÷200)^(1÷6)-1)×100:N)
```

(For the ^ operator press [y^x].)

PV = loan amount, or present value.
PMT = monthly payment amount.
I%YR = annual (Canadian) interest rate as a percent.
N = total number of payment periods for the life of the loan.
FV = remaining balance, or future value.

For instructions on entering Solver equations, see "Solving Your Own Equations," on page 29.

Advance Payments (Leasing)

Occasionally payments are made in advance, such as in leasing. Leasing agreements sometimes call for the extra payments to be made when the transaction is closed. A residual value (*salvage value*) can also exist at the end of the normal term.

The following equation calculates the monthly payment and the annual yield when one or more payments are made in advance. It can be modified to accommodate periods other than monthly by changing the number 12 to the appropriate number of payment periods per year.

Remember the cash-flow sign convention: money paid out is negative, money received is positive.

A Solver Equation for Advance Payments:

```
ADV: PMT=(-PV-FV×(SPPV(I%YR÷12;N)))÷
          (USPV(I%YR÷12;N-#ADV)+#ADV)
```

(For the # character press [WXYZ] [OTHER] [#].)

PMT = the monthly payment amount.
PV = the value of the equipment.
FV = the residual value.

I%YR = the annual interest rate as a percent.
N = the total number of payments.
#ADV = the number of advance payments.

The following example assumes that you have entered the equation ADV, above, into the Solver. For instructions on entering Solver equations, see "Solving Your Own Equations," on page 29.

Example: Leasing with Advance Payments. Equipment worth $750 is leased to you for 12 months. The equipment is assumed to have no salvage value at the end of the lease. You agree to make three payments at the time of closing. What is the monthly payment if the annual interest rate is 10%**?**

Select the ADV equation in the Solver.

Keys:	**Display:**	**Description:**
CALC		Creates menu.
750 PV		Stores known values.
12 N		
0 FV		
3 #ADV		
10 I%YR	I%YR=10.00	
PMT	PMT=-64.45	Calculates payment.

Savings

Value of a Fund with Regular Withdrawals

Example: A Fund with Regular Withdrawals. What are the balances after 1, 10, and 20 years of a fund that starts at $750,000, has $20,000 withdrawn at the beginning of each quarter, and earns 10% annual interest compounded monthly**?**

1. Because the compounding periods and the withdrawal periods are not coincident, you must first convert the nominal interest rate to one in terms of the withdrawal periods. You can do this using the ICNV menu, as explained on page 87, "Compounding Periods Different from Payment Periods."
2. The rest of the calculation is a straightforward TVM problem. Remember that money deposited is paid out and therefore negative; money withdrawn is received and therefore positive.

Step 1: Find the adjusted nominal interest rate.

Keys:	Display:	Description:
FIN ICNV PER	COMPOUNDING P TIMES/YR	Displays periodic interest-rate conversion menu.
12 P	P=12.00	Stores number of compounding periods.
10 NOM%	NOM%=10.00	Stores nominal interest rate.
EFF%	EFF%=10.47	Calculates effective interest rate.
4 P	P=4.00	Stores number of withdrawal periods.
NOM%	NOM%=10.08	Calculates adjusted nominal interest rate.

Step 2: Calculate the future values.

Keys:	Display:	Description:
EXIT EXIT TVM		Switches to TVM menu.

◀	10.08	Clears message to show *NOM%* value still in calculator line.
STO I%YR	I%YR=10.08	Stores adjusted nominal interest rate in *I%YR*.
OTHER 4 P/YR BEG EXIT	4 P/YR BEGIN MODE	Sets 4 payments (withdrawals) per year and Begin mode.
750000 +/− PV	PV=−750,000.00	Stores present (initial) value of fund.
20000 PMT	PMT=20,000.00	Stores withdrawal amount.
4 N	N=4.00	Stores number of withdrawals in 1 year.
FV	FV=743,364.31	Value of fund at end of year 1.
40 N	N=40.00	Stores number of withdrawals over 10 years.
FV	FV=641,824.41	Calculates value of fund at end of year 10.
20 ▼ N	N=80.00	Stores number of withdrawals after 20 years.
FV	FV=348,988.60	Calculates value of fund at end of year 20.

Deposits Needed for a Child's College Account

See appendix F for RPN keystrokes for this example.

Suppose you want to start saving now to accommodate a future series of cash outflows. An example of this is saving money for college. To determine how much you need to save each period, you must know when you'll need the money, how much you'll need, and at what interest rate you can invest your deposits.

Use a CFLO list to calculate the net uniform series (*NUS*) of the future withdrawals:

1. Store zero for all cash flows except the withdrawals. For those cash flows, store the amounts you will need to withdraw (since this is cash received, these cash flows will be *positive*).
2. Store the periodic interest rate in *I%* and calculate *NUS*. The *NUS* equals the amount of the monthly deposit you will need to make.

You can also calculate the equivalent present value of all the monthly deposits combined by calculating the net present value, *NPV*.

Example: Savings for College. Your daughter will be going to college in 12 years and you are starting a fund for her education. She will need $15,000 at the beginning of each year for four years. The fund earns 9% annually, compounded monthly, and you plan to make monthly deposits, starting at the end of the current month. How much should you deposit each month to meet her educational expenses**?**

The cash-flow diagram looks like this:

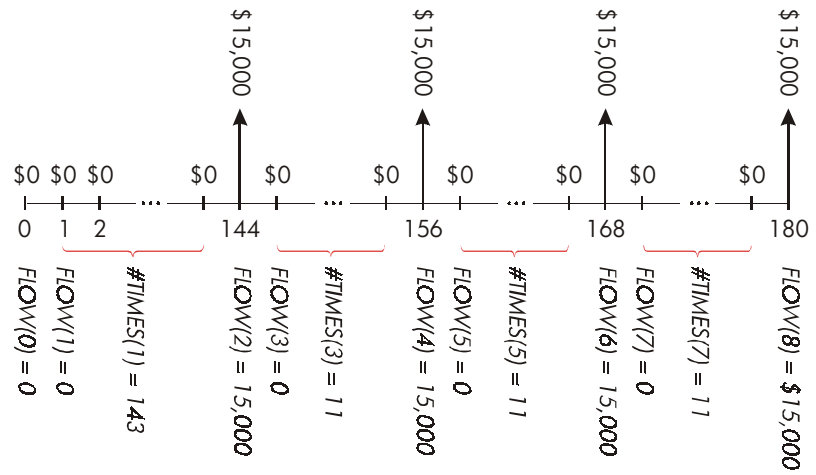


Figure 14-1. Flow of Withdrawals

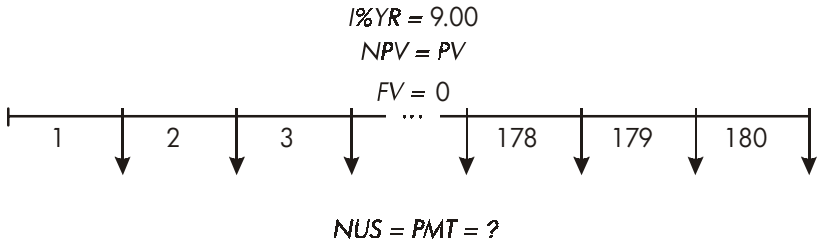


Figure 14-2. Flow of Deposits

Keys:	Display:	Description:
FIN CFLO		Displays current cash-flow list and CFLO menu keys.
CLR DATA YES *or* GET *NEW	FLOW(0)=?	Clears current list or gets a new one.

Step 1: Set up a CFLO list.

0 INPUT	FLOW(1)=?	Sets initial cash flow, *FLOW(0)*, to zero.
0 INPUT	#TIMES(1)=1	Stores zero in *FLOW(1)* and prompts for the number of times it occurs.
12 × 12 − 1 INPUT	FLOW(2)=?	Stores 143 (for 11 years, 11 months) in *#TIMES(1)* for *FLOW(1)*.
15000 INPUT	#TIMES(2)=1	Stores amount of first withdrawal, at end of 12th year.
INPUT	FLOW(3)=?	
0 INPUT	#TIMES(3)=1	Stores cash flows of zero...
11 INPUT	FLOW(4)=?	...for the next 11 months.
15000 INPUT		Stores second withdrawal,
INPUT	FLOW(5)=?	for sophomore year.
0 INPUT		Stores cash flows of zero
11 INPUT	FLOW(6)=?	for the next 11 months.
15000 INPUT		Stores third withdrawal,
INPUT	FLOW(7)=?	for junior year.
0 INPUT		Stores cash flows of zero
11 INPUT	FLOW(8)=?	for the next 11 months.
15000 INPUT		Stores fourth withdrawal,
INPUT	FLOW(9)=?	for senior year.
EXIT CALC	NPV, NUS, NFV NEED I%	Done entering cash flows; gets CALC menu.

Step 2: Calculate *NUS* for the monthly deposit.

Keys:	Display:	Description:
9 ÷ 12		Figures the periodic (monthly) interest rate and stores it in *I%*.
I%	I%=0.75	
NUS	NUS=182.30	Amount of monthly deposit needed to meet planned withdrawals.
NPV	NPV=17,973.48	Calculates the net present value of the monthly deposits, which is the same as the *NPV* of the four future withdrawals.

Value of a Tax-Free Account

See appendix F for RPN keystrokes for this example.

You can use the TVM menu to calculate the future value of a tax-free or tax-deferred account, such as an IRA or Keogh account. Remember that for calculations with cash flows, money paid out is negative and money received is positive. (Current tax law and your current income will determine whether just interest or also principal are tax-free, and for how long. You can solve for either case.)

N = the number of payments until retirement.
I%YR = the annual dividend rate.
PV = the present value of the retirement account.
PMT = the amount of your deposit. (It must be constant for the duration of the account.)
FV = the future value of the retirement account.

The purchasing power of that future value depends on the inflation rate and the duration of the account.

Example: Tax-Free Account. Consider opening an IRA account with a dividend rate of 8.175%. 1) If you invest $2,000 at the beginning of each year for 35 years, how much will you have at retirement**?** 2) How much will you have paid into the IRA**?** 3) How much interest will you have earned**?** 4) If your post-retirement tax rate is 15%, what is the after-tax future value of the account**?** Assume only the interest will be taxed. (Assume the principal was taxed before deposit.) 5) What is the purchasing power of that amount, in today's dollars, assuming an 8% annual inflation rate**?**

Keys:	**Display:**	**Description:**
FIN TVM OTHER 1 P/YR BEG EXIT	1 P/YR BEGIN MODE	Sets 1 payment per year and Begin mode.
35 N	N=35.00	Stores number of payment periods until retirement (1 × 35).
8.175 I%YR	I%YR=8.18	Stores dividend rate.
0 PV	PV=0.00	Present value of account (before first payment).
2000 +/- PMT	PMT=-2,000.00	Annual payment (deposit).
FV	FV=387,640.45	Calculates amount in account at retirement.
RCL PMT ✓ × RCL ✓ N =	-70,000.00	Calculates total amount paid into IRA by retirement.
✓ + RCL ✓ FV =	317,640.45	Calculates interest you will earn.

✓ × 15 % =	47,646.07	Taxes at 15% of interest.
✓ +/− + RCL		Subtracts taxes from total
✓ FV =	339,994.39	*FV* to calculate after-tax *FV*.
FV	FV=339,994.39	Stores after-tax future value in *FV*.
8 I%YR		Calculates present-value
0 PMT		purchasing power of the
PV	PV=−22,995.36	above after-tax *FV* at 8% inflation rate.

Value of a Taxable Retirement Account

See appendix F for RPN keystrokes for this example.

This problem uses the TVM menu to calculate the future value of a *taxable* retirement account that receives regular, annual payments beginning today (Begin mode). The annual tax on the interest is paid out of the account. (Assume the deposits have been taxed already.)

N = the number of years until retirement.
I%YR = the annual interest rate diminished by the tax rate:
interest rate × (1 − *tax rate*).
PV = the current amount in the retirement account.
PMT = the amount of the annual payment.
FV = the future value of the retirement account.

Example: Taxable Retirement Account. If you invest $3,000 each year for 35 years, with dividends taxed as ordinary income, how much will you have in the account at retirement**?** Assume an annual dividend rate of 8.175% and a tax rate of 28%, and that payments begin today. What will be the purchasing power of that amount in today's dollars, assuming 8% annual inflation**?**

Keys:	Display:	Description:
FIN TVM		Displays TVM menu.
OTHER 1 P/YR		Sets 1 payment per year
BEG EXIT	1 P/YR BEGIN MODE	and Begin mode.
35 N	N=35.00	Stores years until retirement.
8.175 − 28 %	8.18-2.29	Calculates and stores
I%YR	I%YR=5.89	interest rate diminished by tax rate.
0 PV	PV=0.00	Stores no present value.
3000 +/- PMT	PMT=-3,000.00	Stores annual payment.
FV	FV=345,505.61	Calculates future value.
8 I%YR		Calculates present-value
0 PMT		purchasing power of the
PV	PV=-23,368.11	above *FV* at 8% inflation.

Modified Internal Rate of Return

When there is more than one sign change (positive to negative or negative to positive) in a series of cash flows, there is a potential for more than one *IRR%*. For example, the cash-flow sequence in the following example has three sign changes and hence up to three potential internal rates of return. (This particular example has three positive real answers: 1.86, 14.35, and 29.02% monthly.)

The Modified Internal Rate of Return (MIRR) procedure is an alternative that can be used when your cash-flow situation has multiple sign changes. The procedure eliminates the sign change problem by utilizing reinvestment and borrowing rates that you specify. Negative cash flows are discounted at a *safe rate* that reflects the return on an investment in

a liquid account. The figure generally used is a short-term security (T-bill) or bank passbook rate. Positive cash flows are reinvested at a *reinvestment rate* that reflects the return on an investment of comparable risk. An average return rate on recent market investments might be used.

1. In the CFLO menu, calculate the present value of the *negative* cash flows (*NPV*) at the *safe* rate and store the result in register 0. Enter zero for any cash flow that is positive.
2. Calculate the future value of the *positive* cash flows (*NFV*) at the *reinvestment* rate and store the result in register 1. Enter zero for any cash flow that is negative.
3. In the TVM menu, store the total number of periods in *N*, the *NPV* result in *PV*, and the *NFV* result in *FV*.
4. Press I%YR to calculate the periodic interest rate. This is the modified internal rate of return, MIRR.

Example: Modified IRR. An investor has an investment opportunity with the following cash flows:

Group (FLOW no.)	No. of Months (#TIMES)	Cash Flow, $
0	1	−180,000
1	5	100,000
2	5	−100,000
3	9	0
4	1	200,000

Calculate the MIRR using a safe rate of 8% and a reinvestment (risk) rate of 13%.

Keys:	Display:	Description:
FIN CFLO		Displays current cash-flow list.
CLR DATA YES		Clears current list or gets a

or		new one.
GET #NEW	FLOW(0)=?	
180000 +/−		Stores initial cash flow,
INPUT	FLOW(1)=?	*FLOW(0)*.
0 INPUT	#TIMES(1)=1	Stores *FLOW(1)* as zero since the flow amount is positive.
5 INPUT	FLOW(2)=?	Stores 5 for *#TIMES(1)*.
100000 +/−		Stores *FLOW(2)*.
INPUT	#TIMES(2)=1	
5 INPUT	FLOW(3)=?	Stores *FLOW(2)* 5 times. You can skip *FLOW(3)* and *FLOW(4)* because they are equal to zero for this part.
EXIT CALC	NPV, NUS, NFV NEED I%	
✓8 ÷ 12		Stores monthly safe
I%	I%=0.67	interest rate.
NPV	NPV=−654,136.81	Calculates *NPV* of negative cash flows.
STO 0	NPV=−654,136.81	Stores *NPV* in register 0.
EXIT	FLOW(3)=?	Returns to CFLO menu.
CLR DATA YES	FLOW(0)=?	Clears list.
0 INPUT	FLOW(1)=?	Stores zero as *FLOW(0)*. (Skip negative flows; store positive flows.)
100000 INPUT		Stores *FLOW(1)* 5 times.
5 INPUT	FLOW(2)=?	
0 INPUT		Stores zero for *FLOW(2)*,

5 INPUT	FLOW(3)=?	5 times.
0 INPUT		Stores zero for *FLOW(3)*,
9 INPUT	FLOW(4)=?	9 times.
200000 INPUT		Stores *FLOW(4)*, 1 time.
INPUT	FLOW(5)=?	
EXIT CALC	NPV, NUS, NFV NEED I%	
✓13 ÷ 12		Stores monthly
I%	I%=1.08	reinvestment rate.
NFV	NFV=800,582.75	Calculates *NFV* of positive cash flows.
STO 1	NFV=800,582.75	Stores *NFV* in register 1.
MAIN FIN		Switches to TVM menu;
TVM OTHER		sets 12 periods per year
CLR DATA EXIT	12 P/YR END MODE	with End mode, if necessary.
20 N	N=20.00	Stores total number of investment periods.
RCL 0 PV	PV=-654,136.81	Recalls present value of negative cash flows and stores in *PV*.
RCL 1 FV	FV=800,582.75	Recalls future value of positive cash flows and stores in *FV*.
0 PMT	PMT=0.00	Stores zero in *PMT* (no payments).
I%YR	I%YR=12.18	Calculates annual MIRR.

Price of an Insurance Policy

The price of an insurance policy, other than term life insurance, is rarely apparent at first glance. The price should include not only the premium payments, but also the interest that could have been earned on the cash value or *savings portion* of the policy.

The following equation calculates the price per $1,000 of protection for one policy year and the interest rate earned on the savings portion of the policy.

To calculate the price, assume some value for interest—for example, the interest rate you could earn on a one-year savings certificate after tax. Similarly, to calculate interest, assume a price per $1,000 per year for alternative insurance; for example, a low-cost term policy of the one-year renewable type.

Even complex policies like minimum-deposit plans can be analyzed with this procedure. Use policy surrender values for cash values and the actual (after-tax) amounts for payments (premiums) and dividends.

A Solver Equation for Insurance Price:

```
INS=((PREM+LVAL)×(1+I%÷100)-VAL-DIV)÷
          (.001×(FACE-VAL))
```

INS = the price per $1,000 of protection in one policy year.
PREM = the annual premium amount.
LVAL = the value of the policy at the end of last year.
I% = the rate of return, as a percent, on a savings account.
VAL = the value of the policy at the end of the current year.
DIV = the dollar value of the dividend for one year.
FACE = the face value of the policy for one year.

The following example assumes that you have entered the above equation into the Solver. For instructions on entering Solver equations, see "Solving Your Own Equations," on page 30.

Example: Insurance Policy. You are evaluating your $50,000 insurance policy. The premium of $1,010 is due at the beginning of the year, and a dividend of $165 is received at the end of the policy year. The cash value of the policy is $3,302 at the beginning of the year; it will grow to $4,104 by the end of the year. You can earn 6% on a savings account. What is the annual price per $1,000 protection**?**

Select the correct equation in the Solver.

Keys:	**Display:**	**Description:**
CALC		Creates menu.
1010 PREM	PREM=1,010.00	Stores annual premium.
3302 LVAL	LVAL=3,302.00	Stores value of policy at end of last year.
6 I%	I%=6.00	Stores interest rate you could get elsewhere.
4104 VAL	VAL=4,104.00	Stores value of policy at end of this year.
MORE		Stores annual dividend.
165 DIV	DIV=165.00	
50000 FACE	FACE=50,000.00	Stores face value of policy.
MORE INS	INS=6.57	Your protection cost $6.57 per $1,000 face (protection) value.

Insurance protection could be purchased for $3 per $1,000 face value. Calculate the rate of return on your savings.

Keys:	**Display:**	**Description:**
3 INS	INS=3.00	Stores price of alternate insurance.
I%	I%=2.20	Calculates rate of return.

Reference: Joseph M. Belth, *Life Insurance—A Consumer's Handbook*, Indiana University Press, 1973, p. 234.

Bonds

Example: Yield to Maturity and Yield to Call. On March 16, 2003 you consider the purchase of a $1,000 bond that was issued on January 1, 2001. It has a 10.5% semiannual coupon using a 30/360 calendar, and matures on January 1, 2031. The bond is callable on January 1, 2006 at 110 (that is, $1,100). The bond is now selling at 115.174 (that is, $1,151.74). Determine both the yield to maturity and the yield to call for this bond.

First, calculate the yield to maturity:

Keys:	Display:	Description:
FIN BOND		Displays BOND menu.
TYPE 360		Sets semiannual bond
SEMI EXIT	30/360 SEMIANNUAL	on 30/360 calendar.
◆ CLR DATA	30/360 SEMIANNUAL	Clears variables; sets *CALL* to 100.
3.162003 SETT	SETT= 03/16/2003 SUN	Stores today as purchase date.
1.012031 MAT	MAT=01/01/2031 WED	Stores maturity date.
10.5 CPN%	CPN%=10.50	Stores coupon rate.
MORE		Stores price. Displays only two decimal places, but stores all three.
115.174 PRICE	PRICE=115.17	
YLD%	YLD%=9.00	Calculates yield to maturity.

Second, calculate the yield to call:

Keys:	Display:	Description:
MORE	YLD%=9.00	Returns to first BOND menu.
1.012006		Changes maturity date
MAT	MAT=01/01/2006 SUN	to the call date.
110 CALL	CALL=110.00	Stores call value.
MORE YLD%	YLD%=7.63	Calculates a yield to call.

Discounted Notes

A note is a written agreement to pay to the buyer of the note a sum of money plus interest. Notes do not have periodic coupons, since all interest is paid at maturity. A discounted note is a note that is purchased below its face value. The following equations find the price or yield of a discounted note. The calendar basis is actual/360.

Solver Equations for Discounted Notes: To find the price given the discount rate:

```
NOTE:PRICE=RV-(DISC×RV×DDAYS(SETT:MAT:1)÷36000)
```

To find the yield given the price (or to find the price given the yield):

```
NOTE:YIELD=(RV-PRICE)÷PRICE×36000÷
          DDAYS(SETT:MAT:1)
```

PRICE = the purchase price per $100 face value.
YIELD = the yield as an annual percentage.
RV = the redemption value per $100.
DISC = the discount rate as a percent.
SETT = the settlement date (in current date format).
MAT = the maturity date (in current date format).

The following example assumes that you have entered the NOTE equations into the Solver. For instructions on entering Solver equations, see "Solving Your Own Equations," on page 30.

Example:Price and Yield of a Discounted Note. What are the price and yield of the following U.S. Treasury Bill: settlement date October 14, 2003; maturity date March 17, 2004; discount rate 8.7%**?** (Assume month/day/year format.)

Select the NOTE:PRICE equation in the Solver.

Keys:	Display:	Description:
CALC		Creates menu.
10.142003		Stores known values.
SETT	SETT=10.14	
3.172004		
MAT	MAT=3.17	
8.7 DISC	DISC=8.70	
100 RV	RV=100.00	
PRICE	PRICE=96.25	Calculates price.
EXIT ▼ CALC	NOTE:YIELD=	Displays NOTE:YIELD
	(RV-PRICE)…	equation, then its menu.
YIELD	YIELD=9.04	Calculates yield.

Statistics

Moving Average

Moving averages are often useful in predicting trends in data taken over a period of time. In moving-average calculations, a specified number of points is averaged. Each time a new point is acquired, the oldest point is discarded. Thus, the same number of points is used in each calculation.

A Solver Equation for Moving Averages:

```
MAVG=Σ(I:MAX(1:LAST-N+1):LAST:1:ITEM(name:I))÷
                    MIN(N:LAST)
```

N = the number of values averaged in each calculation.
LAST = the item number of the most recent value to be averaged.

name = the name of the SUM list whose data will be averaged. When you create and name the SUM list, make sure its name matches the *name* in the Solver equation.

The following example assumes that you have entered the equation MAVG into the Solver, using VOL for the SUM list's name. For instructions on entering Solver equations, see "Solving Your Own Equations," on page 30.

Example: A Moving Average in Manufacturing. Calculate a three-month moving average for the number of units manufactured during the first half of the year. Manufacturing volumes are:

January	February	March	April	May	June
4400	5360	2900	3670	4040	3200

Keys:	Display:	Description:
SUM		Displays SUM menu and current list.
▼ CLR DATA YES		Clears current list or gets
or		
GET *NEW	ITEM(1)=?	a new one.
4400 INPUT		Enters data.
5360 INPUT		
2900 INPUT		
3670 INPUT		

4040 INPUT		
3200 INPUT	ITEM(7)=?	
	TOTAL=23,570.00	
EXIT NAME		Names the list VOL.
VOL INPUT	ITEM(7)=?	
EXIT SOLVE		Displays the MAVG
(use ▼ and ▲		equation. Make sure
if necessary)		name is VOL.
CALC		Displays menu.
3 N	N=3.00	Stores number of points.
3 LAST		Calculates average for
MAVG	MAVG=4,220.00	months 1, 2, and 3.
4 LAST		Calculates average for
MAVG	MAVG=3,976.67	months 2, 3, and 4.
5 LAST		Calculates average for
MAVG	MAVG=3,536.67	months 3, 4, and 5.
6 LAST		Calculates average for
MAVG	MAVG=3,636.67	months 4, 5, and 6.

Chi-Squared (χ^2) Statistics

The χ^2 statistic is a measure of the goodness of fit between data and an assumed distribution.* It is used to test whether a set of observed frequencies differs from a set of expected frequencies sufficiently to reject the hypothesis under which the expected frequencies were obtained.

* The statistic can be assumed to be χ^2 distributed with $n-1$ degrees of freedom if n or some of the E_i values are large.

In other words, it tests whether discrepancies between the observed frequencies (O_i) and the expected frequencies (E_i) are significant, or whether they might reasonably result from chance. The equation is:

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

If there is a close agreement between the observed and expected frequencies, χ^2 will be small. If the agreement is poor, χ^2 will be large.

Solver Equations for χ^2 Calculations:

If the expected value is a constant:

```
CHI=Σ(I:1:SIZES(name1):1:(ITEM(name1:I)
                -EXP)^2÷EXP)
```

If the expected values vary:

```
CHI2=Σ(I:1:SIZES(name1:1:(ITEM(name1:I)
    -ITEM(name2:I))^2÷ITEM(name2:I))
```

(To enter the Σ character, press WXYZ OTHER MORE Σ.)

CHI2 = the final χ^2 value for your data.
name1 = the name of the SUM list that contains the *observed values*.
name2 = the name of the SUM list that contains the *expected values*.
EXP = the expected value when it is a constant.

When you create and name the SUM list(s), make sure the name(s) match *name1* (and *name2*, if applicable) in the Solver equation.

To solve the equation, press CHI2 once or twice (until you see the message CALCULATING…).

The following example assumes that you have entered the CHI equation into the Solver, using OBS for *name1*. For instructions on entering Solver equations, see "Solving Your Own Equations," on page 30.

Example: Expected Throws of a Die. To determine whether a suspect die is biased, you toss it 120 times and observe the following results. (The expected frequency is the same for each number, 120 ÷ 6, or 20.)

Number	1	2	3	4	5	6
Frequency Observed	25	17	15	23	24	16

Keystroke:	**Display:**	**Description:**
SUM		Displays SUM menu and current list.
CLR DATA YES		Clears current list or gets a new one.
or		
GET ⁂NEW	ITEM(1)=?	
25 INPUT		Enters observed values.
17 INPUT		
15 INPUT		
23 INPUT		
24 INPUT		
16 INPUT	ITEM(7)=?	
	TOTAL=120.00	
EXIT NAME		Names the list OBS.
OBS INPUT	ITEM(7)=?	
EXIT SOLVE		Displays the CHI equation. Make sure *name1* is OBS.
(*use* ▲ *and* ▼ *if necessary*)		
CALC		Displays menu.
20 EXP	EXP=20.00	Stores expected value.
CHI	CHI=5.00	Calculates χ^2.

The number of degrees of freedom is $(n-1)=5$. Consult statistical tables to find χ^2 to a significance level of 0.05 with 5 degrees of freedom. The table shows that $\chi^2_{0.05,5}=11.07$. Since the computed value (5.00) is less than 11.07, you can conclude that, to a 0.05 significance level (95% probability), the die is fair.

A

Assistance, Batteries, Memory, and Service

Obtaining Help in Operating the Calculator

Hewlett-Packard is committed to supporting users of HP calculators. You can obtain answers to your questions about using the calculator from our Calculator Support department.

We suggest reading "Answers to Common questions," below, before contacting us. Past experience has shown that many of our customers have similar questions.

Answers to Common Questions

Q: 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**?**
A: Refer to page 232, which describes the diagnostic self-test.

Q: My arithmetic keys don't work like I expect. I press 12 [+] 3 [=] and get 3.00.
A: You may be in the wrong mode. Press [MODES] ALG to set Algebraic mode.

Q: My numbers contain commas as decimal points. How do I restore the periods**?**
A: Press [DSP] . .

Q: How do I change the number of decimal places the calculator displays**?**
A: The procedure is described in "Decimal Places" on page 34.
Q: How do I clear all or portions of memory**?**
A: [CLR] clears the calculator line. [CLR DATA] clears the data lists or variables accessible from the current menu. Erasing the entire contents of memory is covered in "Erasing Continuous Memory" on page 230.

Q: Why am I getting the wrong answer using the TVM menu**?**
A: Be sure to enter a value for *all five TVM variables*, even if a value is zero (as *FV* is for a loan without a balloon). Clearing the variables before starting ([CLR DATA]) accomplishes the same thing. Check the appropriate payment mode (mortgages and loans are typically End mode calculations), and specify the number of payments per year (P/YR). Also check that all figures for money paid out are *negative* (the cash-flow sign convention).

Q: Can I access the TVM menu functions from the Solver**?**
A: No, but you can do the same functions by copying the appropriate financial formulas into the Solver. The formulas are given starting on page 168.

Q: Can I access the data stored in my CFLO and SUM lists from the Solver**?**
A: Yes. See "Accessing CFLO and SUM Lists from the Solver," page 177.

Q: How do I indicate multiplication in an equation typed into the Solver**?**
A: Use the multiplication key ([×]). You cannot use the letter X in the ALPHA menu.

Q: What does an "E" in a number (for example, 2.51E−13) mean**?**
A: *Exponent* of ten (for example, 2.51×10^{-13}). Refer to "Scientific Notation" on page 47.

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

A: Refer to "Managing Calculator Memory" on page 227 for instructions on how to reclaim memory for your use.

Q: The calculator is operating slowly, and the  annunciator is blinking. Why**?**
A: The calculator is trace printing. Press ▬ PRINTER TRACE EXIT to turn off tracing.

Q: How can I change the sign of a number in a list without keying in the number again**?**
A: Press RCL INPUT +/− INPUT .

Q: The beeper is not working.
A: Check the beeper mode by pressing ▬ MODES BEEP. See also page 36.

Q: The messages and the menu labels in the display are not in English. How do I restore the English**?**
A: Models of the hp 17bII+ sold in many countries outside of the United States include a menu to select the language for messages and labels. To select the English language, press ▬ MODES INTL ENGL .

Power and Batteries

The calculator is power by two 3-volt lithium coin batteries.
When changing batteries, use only fresh button-cell batteries. Both batteries must be changed at the same time.
Do not use rechargeable batteries.

Low-Power Indications

When the low-battery annunciator () comes on, the calculator can continue normal operation for several hours. If the calculator is turned off. Continuous Memory will be preserved for approximately two weeks. To conserve battery power, printing does not function when the battery annunciator is on. Printing might halt during a printing operation

due to a borderline low-battery condition. The calculator can detect that there is insufficient power for printing before the battery annunciator comes on.

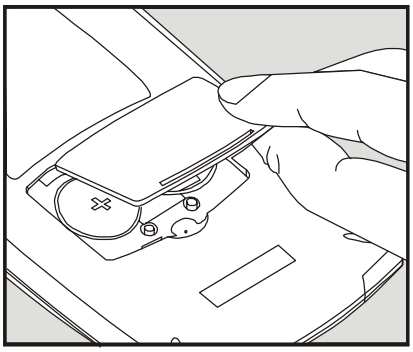
If you continue to use the calculator after the battery annunciator comes on, power can eventually drop to a level at which the calculator stops powering the display and keyboard. The calculator will require fresh batteries before it can be turned back on. When you turn the calculator on after fresh batteries have been installed, the calculator displays `MACHINE RESET` if your stored data is intact. If data has been lost, the calculator displays `MEMORY LOST`. In either case, the clock's time might be incorrect.

Installing Batteries

Once the batteries are removed, you must replace the batteries within 30 seconds to prevent loss of Continuous Memory.

To install batteries:

1. Have two fresh CR2032 batteries at hand. Hold batteries by the edges. Do not touch the contacts. Wipe each battery with a clean, lint-free cloth to remove dirt and oil.
2. Make sure the calculator is *off*. **Do not press [CLR] again until the entire procedure for changing batteries is completed. Changing batteries with the calculator on can erase the contents of Continuous Memory**. If you have set any appointments, make sure they will not come due while the batteries are out.
3. Turn the calculator over and prize off the battery cover.



4. **Never remove two old batteries at the same time, in case memory lost**. Remove one of the two batteries once. Insert a new battery, making sure that the positive sign (+) is facing outward.

Warning

Do not mutilate, puncture, or dispose of batteries in fire. The batteries can burst or explode, releasing hazardous chemicals.

5. Remove and insert the other battery as step 4. Make sure that the positive sign (+) on each battery is facing outward.
6. Replace the battery compartment cover.
7. Press on.

Now turn the calculator back on. If it does not function, you might have taken too long to change the batteries or inadvertently turned the calculator on while the batteries were out. *Remove the batteries* again and lightly press a coin against both battery contacts in the calculator *for a few seconds*. Put the batteries back in and turn the calculator on. You should see `MEMORY LOST`.

Managing Calculator Memory

The calculator has approximately 30,740 units (or "bytes") of *user* memory available. (This is separate from the *system* memory that stores all the unerasable information with which the calculator is manufactured.)

The calculator displays `INSUFFICIENT MEMORY` if you attempt an operation that uses more memory than is currently available. If you see this message:

1. Complete any calculations in the calculator line (press [=] or [CLR]). This frees the memory that was being used to store each of the numbers and operators.
2. To further increase the amount of available memory:
   Rename the named SUM and CFLO lists with shorter names (see page 98), and clear any lists you no longer need (see page 99).

   - Shorten or delete any messages with appointments (see page 146).
   - Delete any Solver variables or equations you no longer need (see page 164).

Resetting the Calculator

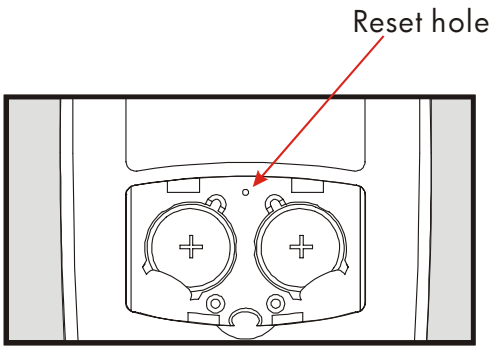
If the calculator doesn't respond to keystrokes or is behaving unusually, attempt to reset it. Resetting the calculator halts the current calculation, clears the calculator line, and displays the MAIN menu. Stored data remains intact except setting those conditions: double-space printing off, printer tracing off, printer without the ac adapter, and beeper on.

To reset the calculator, hold down CLR while pressing the third menu key from the left. Repeat if necessary. The calculator displays `MACHINE RESET` to confirm that reset has occurred.

The calculator can reset itself if it is dropped or if power is interrupted.

If the calculator still does not respond to keystrokes, use the following procedures.

1. Use a thin, pointed object to press the reset hole near of the battery compartment.



2. The calculator displays the INTL (international) menu. You must specify a language before proceeding (see page 18 for information about the setting the language).

3. The display will show `MEMORY LOST`. Pressing any key will clear this message from the display.

For selecting English language:

- ALG mode
- Month/day/year date format, 12-hour clock
- 2 decimal places, period (.) decimal point
- Double-space printing off, printer tracing off, printer without the ac adapter
- Beeper on
- APPT default time 00.00.00 12:00A, default time WED 01.01.03 12:00:00A
- Erased Continuous Memory
- U.S Dollars and EURO Dollars currencies and the rate equals 1.0000.

For selecting the other languages:

- ALG mode
- Day/month/year date format, 24-hour clock
- 2 decimal places, comma (,) decimal point
- Double-space printing off, printer tracing off, printer without the ac adapter
- Beeper on
- APPT default time 00.00.00 00:00, default time WED 01.01.03 00:00:00
- Erased Continuous Memory
- U.S Dollars and EURO Dollars currencies and the rate equals 1.0000.

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. In addition, the calculator is set to certain "default" settings.

- Clears the calculator line and history stack.
- Deletes all Solver equations and their variables, and clears all other variables in menus.
- Clears all CFLO and SUM lists and their names.
- Clears all appointments.
- Returns U.S Dollars and EURO Dollars currencies and the rate equals 1.0000.
- Sets those conditions:
  For English language:
  Month/day/year date format, 12-hour clock, 2 decimal places, period (.) decimal point, double-space printing off, printer tracing off, printer without the ac adapter, and beeper on.
  For the other languages:
  Day/month/year date format, 24-hour clock, 2 decimal places, comma (,) decimal point, double-space printing off, printer tracing off, printer without the ac adapter, and beeper on.

- Maintains the selected mode—ALG or RPN.

Erasing Continuous Memory does not affect the current time and date, date and the selected language.

To erase Continuous Memory, press and hold down CLR, the leftmost menu key, and the rightmost menu key. (Press three keys simultaneously). When the three keys are released, the calculator displays `MEMORY LOST`.

Continuous Memory can inadvertently be erased if the calculator is dropped or if power is interrupted.

Clock Accuracy

The clock is regulated by a quartz crystal accurate to within 1.5 minutes per month under normal conditions. The accuracy of the clock crystal is affected by temperature, physical shock, humidity, and aging. Optimum accuracy is maintained at 25°C (77°F).

Environmental Limits

In order to maintain product reliability, observe the following limits:

- Operating temperature: 0° to 45°C (32° to 113°F).
- Storage temperature: −20° to 65°C (−4° to 149°F).
- Operating and storage humidity: 90% relative humidity at 40°C (104°F) maximum.

Determining If the Calculator Requires Service

Use these guidelines to determine if the calculator requires service. If it does, read “Service” on page 235.

- **If the calculator won't turn on:**
  1. Attempt to reset the calculator (see page 228).
  2. If the calculator fails to respond after step 1, replace the batteries (see page 225). *If you have just replaced the batteries*, see page 227.

  If these steps do not help, the calculator requires service.

- **If the calculator doesn't respond to keystrokes:**
  1. Attempt to reset the calculator (see page 228).
  2. If the calculator still fails to respond, attempt to erase Continuous Memory (see page 230). This will erase all the information you've stored.

  If these steps do not help, 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 you've made a mistake in operating the calculator. Try rereading portions of the manual, and check "Answers to Common Questions" on page 222.
  3. Contact the Calculator Support department.

Confirming Calculator Operation: 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. The self-test runs continuously, repeating until you halt it.

To run the self-test:

1. Turn the calculator on.

2. If you have the optional infrared printer, turn it on. Certain diagnostic information is printed during the test.
3. If possible, return to the MAIN menu (press ▬ MAIN).
4. To start the self-test, hold down CLR 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.
5. During the test, the calculator beeps periodically and displays various patterns and characters. Watch for one of two messages that are displayed before the test automatically repeats:
   - If the calculator passes the self-test, the calculator displays `OK 17BII+`
   - If the calculator displays `FAIL` followed by a five-digit number, the calculator requires service.
6. To halt the self-test, hold down CLR while you press the third menu key from the left. The calculator displays `MACHINE RESET`. If you press any other key instead, the test halts and the calculator displays a `FAIL` message. *This results from an incorrect key being pressed, and does not mean that the calculator requires service.*
7. If the calculator failed the self-test, repeat steps 4 through 6 to verify the results. If you do not have a printer, write down the messages that are displayed in step 5.

Warranty

hp 17bII+ Financial Calculator; Warranty period: 12 months

1. HP warrants to you, the end-user customer, that HP hardware, accessories and supplies will be free from defects in materials and workmanship after the date of purchase, for the period specified above. If HP receives notice of such defects during the warranty period, HP will, at its option, either repair or replace products which prove to be defective. Replacement products may be either new or like-new.
2. HP warrants to you that HP software will not fail to execute its programming instructions after the date of purchase, for the

period specified above, due to defects in material and workmanship when properly installed and used. If HP receives notice of such defects during the warranty period, HP will replace software media which does not execute its programming instructions due to such defects.

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4. HP products may contain remanufactured parts equivalent to new in performance or may have been subject to incidental use.
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Service

Europe

Country :	Telephone numbers
Austria	+43-1-3602771203
Belgium	+32-2-7126219
Denmark	+45-8-2332844
Eastern Europe countries	+420-5-41422523
Finland	+35-89640009
France	+33-1-49939006
Germany	+49-69-95307103
Greece	+420-5-41422523
Holland	+31-2-06545301
Italy	+39-02-75419782
Norway	+47-63849309
Portugal	+351-22 9570200
Spain	+34-915-642095
Sweden	+46-851992065
Switzerland	+41-1-4395358 (German) +41-22-8278780 (French) **+39-02-75419782** (Italian)
Turkey	+420-5-41422523
UK	+44-207-4580161
Czech Republic	+420-5-41422523
South Africa	+27-11-2376200

	Luxembourg	+32-2-7126219
	Other European countries	+420-5-41422523

Asia Pacific	Country :	Telephone numbers
	Australia	+61-3-9841-5211
	Singapore	+61-3-9841-5211

L.America	Country :	Telephone numbers
	Argentina	0-810-555-5520
	Brazil	Sao Paulo 3747-7799; ROTC 0-800-157751
	Mexico	Mx City 5258-9922; ROTC 01-800-472-6684
	Venezuela	0800-4746-8368
	Chile	800-360999
	Columbia	9-800-114726
	Peru	0-800-10111
	Central America & Caribbean	1-800-711-2884
	Guatemala	1-800-999-5105
	Puerto Rico	1-877-232-0589
	Costa Rica	0-800-011-0524

N.America	Country :	Telephone numbers
	U.S.	1800-HP INVENT
	Canada	(905)206-4663 or 800-HP INVENT

ROTC = Rest of the country

Regulatory information

This section contains information that shows how the hp 17bII+ Financial calculator complies with regulations in certain regions. Any modifications to the calculator not expressly approved by Hewlett-Packard could void the authority to operate the 17bII+ in these regions.

USA

This calculator generates, uses, and can radiate radio frequency energy and may interfere with radio and television reception. The calculator complies with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

However, 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 calculator off and on), the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Relocate the calculator, with respect to the receiver.

Canada

This Class B digital apparatus complies with Canadian ICES-003.

Cet appareil numerique de la classe B est conforme a la norme NMB-003 du Canada.

Japan

この装置は、情報処理装置等電波障害自主規制協議会(VCCI)の基準に基づく第二情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。

取扱説明書に従って正しい取り扱いをしてください。

Noise Declaration

In the operator position under normal operation (per ISO 7779): LpA < 70dB.

B

More About Calculations

IRR% Calculations

The calculator determines *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, this is called an iterative process.

In most cases, the calculator finds the desired 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 calculator 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.

- **Case 1:** The calculator displays a positive answer. This is the only positive answer. However, one or more negative answers may exist.
- **Case 2:** The calculator finds a negative answer but a single positive solution also exists. It displays:

  ```
  IRR%>0 EXISTS; KEY
  IN GUESS; [STO] (IRR%)
  ```

  To see the negative answer, press ◀. To search for that positive answer, you must input a guess. (Refer to "Storing a Guess for *IRR%*"; below). There might also be additional negative answers.
- **Case 3:** The calculator displays a negative answer and no message.

This is the only answer.

- **Case 4:** The calculator displays the message:

  MANY/NO SOLUTIONS; KEY
  IN GUESS; [STO] (IRR%)

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

- **Case 5:** The calculator displays: NO SOLUTION

  There is no answer. This situation might be the result of an error, such as a mistake in keying in the cash flows. A common mistake is to put the wrong sign for a cash flow. A valid cash flow series must have 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 calculator 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%

To enter a guess, key in an estimate of *IRR%* and then press [STO] IRR%.

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

- Before beginning the calculation. This can reduce the time required to calculate an answer.
- After you've halted the calculation.
- After the calculator has halted the calculation due to any of the above cases. For cases 3 and 5, however, no (other) solutions will be found.

When calculating *IRR%* using a guess, the calculator displays the current estimate of *IRR%* and the calculated value of *NPV* for each iteration. The calculation halts when the calculator finds an answer. However, there

may be additional positive or negative answers, or no true solution at all. 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 zero, the best estimate of *IRR%* is the interest rate that yields the value for *NPV* closest to zero.

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%* a value of *I%* that produces an *NPV* close to zero.

Solver Calculations

As noted in chapter12, the Solver uses two methods to find solutions, depending on the complexity of the equation: *direct* and *iterative* (an indirect). To use all the calculating power included in the Solver, it would help 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 variable you are solving for (the *unknown*). Isolating a variable involves rearranging the equation so that the unknown variable is by itself on the left-hand side of the equation. For example, suppose you enter the equation:

$$PROFIT = PRICE - COST$$

If you've stored values for *PROFIT* and *PRICE*, pressing COST causes the Solver to internally rearrange the equation algebraically to solve for *COST* (*COST* is the unknown):

$$COST = PRICE - PROFIT$$

Answers calculated this way are called direct solutions.

For certain equations, the unknown can be isolated, but an answer cannot be calculated with the values stored. Then the calculator displays: SOLUTION NOT FOUND

For example, if you enter an equation:

$$AREA = L \times W$$

and then enter values for *AREA* and *W*, the Solver rearranges the equation to:

$$L = AREA \div W$$

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

The Solver can isolate the unknown variable if the equation meets these conditions:

- The unknown variable occurs only once in the equation.*
- The only functions in which the unknown variable appears are ALOG, DATE, DDAYS (actual calendar only), EXP, EXPM1, IF (in *then* and *else* clauses only), INV, LN, LNP1, LOG, S, SQ, and SQRT.
- The only operators involving the unknown variable are +, −, x, ÷, and ^ (power). 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.

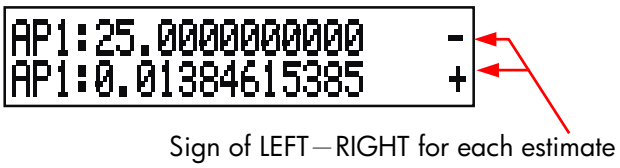
* Exceptions: (1) Occurrences of the unknown variable as the argument of the S function are ignored. (2) The unknown variable can appear twice within an IF function: once in the *then* clause and once in the *else* clause.

† The Solver's ability to find a solution iteratively can often be enhanced by rewriting the equation so that the unknown variable does not appear as a divisor. For example, the Solver may more easily solve for A if the equation 1 ÷ (*A* ^ 2–*A*) = *B* is rewritten as (*A* ^ 2–*A*) × *B* = 1.

Iterative Solutions

If the Solver is not able to isolate the unknown variable, it cannot provide a direct solution. In these cases, the Solver searches iteratively for a solution.*

In its iterative search for a solution, the Solver looks for a value that sets the left side of the equation equal to the right side. To do this, the Solver starts with 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 equation (*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 zero for *LEFT*—*RIGHT*, the Solver analyzes the results 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 this search, the calculator displays the two current estimates and the sign of (*LEFT*—*RIGHT*) for each estimate, as shown.

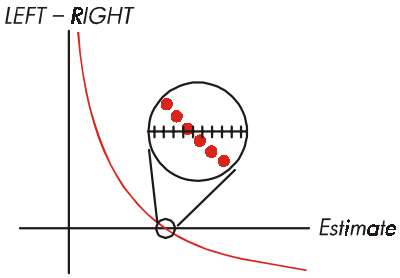


Since calculators cannot do calculations with infinite precision (the hp 17bII+ uses 12 digits in its calculations), sometimes the Solver will be unable to find an estimate where *LEFT*—*RIGHT* is exactly zero. However, the Solver can distinguish between situations where the current estimate *could* be a solution, and situations where no solution is found.

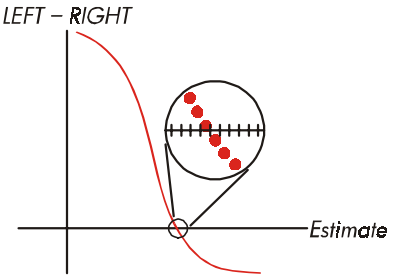
* Exceptions: (1) Occurrences of the unknown variable as the argument of the S function are ignored. (2) The unknown variable can appear twice within an IF function: once in the *then* clause and once in the *else* clause.

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

- **Case 1:** The calculator displays an answer. This is very likely the true solution for the unknown variable.
  There are two situations in which the Solver returns a case 1 answer:
  - **Case 1a:** *LEFT*—*RIGHT* is exactly zero.
  - **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.



Case 1a:
LEFT – *RIGHT* is exactly 0.



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* zero, press the menu key for the unknown variable. If *LEFT*—*RIGHT* is *not* equal to zero, the calculator displays the values of *LEFT* and *RIGHT*.

```
LEFT :0.000000000000
RIGHT:1.000000000000
```

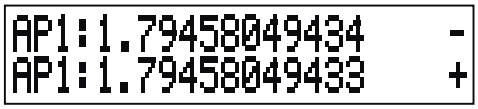
The equation could have more than one iterative solution. If the answer does not seem reasonable, enter one or two guesses and

restart the search.

- **Case 2:** The calculator displays the values of *LEFT* and *RIGHT*, which are unequal. To see the calculator's result, press ◀ or CLR. If *LEFT* and *RIGHT* are relatively close to one another in value, the result is probably a true solution. Otherwise, the result is probably not a true solution.

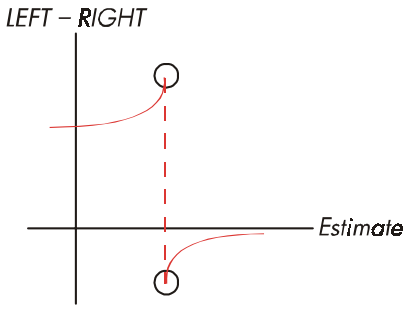
  If the result seems unreasonable, it could be because the equation has more than one solution. You might want to enter one or two guesses and restart the search.

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.

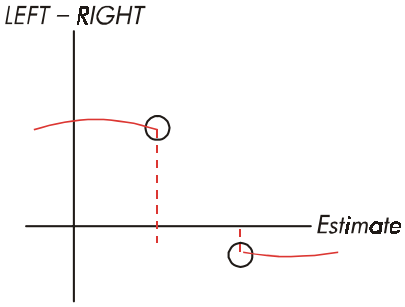


This information can be helpful:

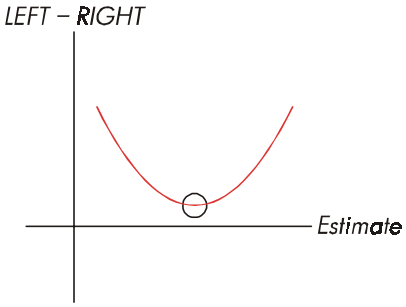
- **Case 2a:** If the signs of *LEFT*−*RIGHT* are opposite, and the two estimates are as close together as two 12-digit numbers can get (neighbors), the Solver found two estimates that "bracket" an ideal solution (a solution where *LEFT*−*RIGHT* equals zero). If *LEFT* and *RIGHT* are relatively close together, the answer is probably a solution.
- **Case 2b:** If the signs of *LEFT*−*RIGHT* are opposite, and the two estimates are not neighbors, 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*. 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.



Case 2a:
LEFT – RIGHT have opposite signs. The two estimates are "neighbors".



Case 2b:
LEFT – RIGHT have opposite signs. The two estimates are far apart.



Case 2c:
LEFT – RIGHT have the same sign..

■ **Case 3:** The calculator displays:

```
BAD GUESSES:
PRESS [CLR] TO VIEW
```

The Solver is unable to begin its iterative search for a solution using the current initial estimates (guesses). You might find a solution by

entering different estimates. The closer you can estimate the answer, the more likely that the Solver will find a solution.

- **Case 4:** The calculator displays: `SOLUTION NOT FOUND`
  The Solver is unable to find a solution. Check your equation to make sure you have made no errors in entering it. Also check the value of each known variable. If your equation and variables are correct, you might be able to find a solution by entering very good guesses.

Equations Used by Built-in Menus

Actuarial Functions

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 made after n periods.)

$$SPPV\ (i\% : n) = \left(1 + \frac{i\%}{100}\right)^{-n}$$

Single Payment Future Value Function
(Future value after n periods of a single $1.00 payment.)

$$SPFV\ (i\% : n) = \left(1 + \frac{i\%}{100}\right)^{n}$$

Uniform Series Present Value Function
(Present value of a $1.00 payment that occurs n times.)

$$USPV\ (i\% : n) = \frac{1 - \left(1 + \frac{i\%}{100}\right)^{-n}}{\frac{i\%}{100}}$$

Uniform Series Future Value Function
(Future value of a $1.00 payment that occurs n times.)

$$USFV\ (i\%:n) \;=\; \frac{\left(1 + \frac{i\%}{100}\right)^{n} - 1}{\frac{i\%}{100}}$$

Percentage Calculations in Business (BUS)

$$\%CHANGE \;=\; \left(\frac{NEW - OLD}{OLD}\right) \times 100$$

$$\%TOTAL \;=\; \left(\frac{PART}{TOTAL}\right) \times 100$$

$$MARKUP\%C \;=\; \left(\frac{PRICE - COST}{COST}\right) \times 100$$

$$MARKUP\%P \;=\; \left(\frac{PRICE - COST}{PRICE}\right) \times 100$$

Time Value of Money (TVM)

S = payment mode factor (0 for End mode; 1 for Begin mode).

$$\text{i\%} \;=\; \frac{\text{I\%YR}}{\text{P/YR}}$$

$$0 = \text{PV} + \left(1 + \frac{i\% \times S}{100}\right) \times PMT \times USPV(i\%:n) + FV \times SPPV(i\%:n)$$

Amortization

$\sum INT$ = accumulated interest
$\sum PRIN$ = accumulated principal
i = periodic interest rate
BAL is initially *PV* rounded to the current display setting.
PMT is initially *PMT* rounded to the current display setting.

$$i \;=\; \frac{I\%YR}{P/YR \times 100}$$

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)
$PRIN = PMT + INT'$
$PRIN = PMT + INT'$
$BAL_{new} = BAL_{old} + PRIN$
$\Sigma INT_{new} = \Sigma INT_{old} + INT$
$\Sigma PRIN_{new} = \Sigma PRIN_{old} + PRIN$

Interest Rate Conversions

Periodic compounding

$$EFF\% = \left[\left(1 + \frac{NOM\%}{100 \times P}\right)^{P} - 1\right] \times 100$$

Continuous compounding

$$EFF\% = \left(e^{\frac{NOM\%}{100}} - 1\right) \times 100$$

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.

$$N_j = \sum_{1 \le I < j} n_I \quad = \text{total number of cash flows prior to group j}$$

$$NPV = CF_0 + \sum_{j=1}^{k} (CF_j \times USPV(i\% : n_j) \times SPPV(i\% : N_j))$$

When $NPV = 0$, the solution for $i\%$ is $IRR\%$.

$$NFV = NPV \times SPFV(i\% : N) \text{ where } N = \sum_{j=1}^{k} n_j$$

$$NUS = \frac{NPV}{USPV(i\% : N)}$$

$$TOTAL = \sum_{j=0}^{k} (n_j \times CF_j)$$

Bond Calculations

Reference: Lynch, John J., Jr. and Jan H. Mayle, *Standard Securities Calculation Methods,* Securities Industry Association, New York, 1986.

A=accrued days, the number of days from beginning of coupon period to settlement date.

E=number of days in coupon period bracketing settlement date. By convention, E is 180 (or 360) if calendar basis is 30/360.

DSC=number of days from settlement date to next coupon date. (*DSC*=*E*−*A*).

M=coupon periods per year (1 = annual, 2 = semiannual),

N=number of coupon periods between settlement and redemption dates. If N has a fractional part (settlement not on coupon date), then round it to the next higher whole number.

Y=annual yield as a decimal fraction, YLD% / 100.

For one or fewer coupon period to redemption:

$$PRICE = \left[\frac{CALL + \frac{CPN\%}{M}}{1 + \left(\frac{DSC}{E} \times \frac{Y}{M} \right)} \right] - \left(\frac{A}{E} \times \frac{CPN\%}{M} \right)$$

For more than one coupon period to redemption:

$$PRICE = \left[\frac{CALL}{\left(1 + \frac{Y}{M}\right)^{N - 1 + \frac{DSC}{E}}}\right] + \left[\sum_{K=1}^{N} \frac{\frac{CPN\%}{M}}{\left(1 + \frac{Y}{M}\right)^{K - 1 + \frac{DSC}{E}}}\right] - \left(\frac{A}{E} \times \frac{CPN\%}{M}\right)$$

The "end-of-month" convention is used to determine coupon dates in the following exceptional situations. (This affects calculations for *YLD%*, *PRICE*, and *ACCRU*.)

- If the maturity date falls on the last day of the month, then the coupon payments will also fall on the last day of the month. For example, a semiannual bond that matures on September 30 will have coupon payment dates on March 31 and September 30.
- If the maturity date of a semiannual bond falls on August 29 or 30, then the February coupon payment dates will fall on the last day of February (28, or 29 in leap years).

Depreciation Calculations

For the given year, *YR#*:

$$ACRS = \frac{ACRS\%}{100} \times BASIS$$

$$SL = \frac{BASIS - SALV}{LIFE}$$

$$SOYD = \frac{BASIS - SALV}{LIFE \times \frac{(LIFE + 1)}{2}} \times (LIFE - YR\# + 1)$$

$$DB = \frac{BASIS \times FACT\%/100}{LIFE} \times \left(1 - \frac{(FACT\%/100)}{LIFE}\right)^{(YR\# - 1)}$$

For the last year of depreciation, *DB* equals the remaining depreciable value for the prior year.

Sum and Statistics

n = number of items in the list.
x' = an element of the sorted list.

$$TOTAL = \Sigma x_i \qquad MEAN = \bar{x} = \frac{\Sigma x_i}{n}$$

$$MEDIAN = x_j' \quad \text{for odd n, where} \quad j = \frac{n+1}{2}$$

$$MEDIAN = \frac{(x_j' + x_{j+1}')}{2} \quad \text{for even n, where} \quad j = \frac{n}{2}$$

$$STDEV = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n-1}}$$

$$W.MN = \frac{\Sigma (y_i - x_i)}{\Sigma y_i} \qquad G.SD = \sqrt{\frac{\Sigma y_i \; x_i^2 - (\Sigma y_i)\,\bar{x}^2}{(\Sigma y_i) - 1}}$$

$$RANGE = MAX - MIN$$

Forecasting

	Model	Transformation	X_i	Y_i
LIN	$y = B + Mx$	$y = B + Mx$	x_i	y_i
EXP	$y = Be^{Mx}$	$\ln y = \ln B + Mx$	x_i	$\ln y_i$
LOG	$y = B + M \ln x$	$y = B + M \ln x$	$\ln x_i$	y_i
PWR	$y = Bx^M$	$\ln y = \ln B + M \ln x$	$\ln x_i$	$\ln y_i$

Let: $\bar{X} = \frac{\Sigma X_i}{n}$ $\bar{Y} = \frac{\Sigma Y_i}{n}$

$SX2 = \Sigma (X_i - \bar{X})^2$ $SX2 = \Sigma (Y_i - \bar{Y})^2$

$SXY = \Sigma (X_i - \bar{X})(Y_i - \bar{Y})$

Then: $M = \frac{SXY}{SX2}$

$B = b$ for LIN and LOG models, and
$B = e^b$ for EXP and PWR models,

where $b = \bar{Y} - M\bar{X}$

$$\text{CORR} = \frac{SXY}{\sqrt{SX2 \times SY2}}$$

Equations Used in Chapter 14

Canadian Mortgages

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

where: $r = \left[\left(1 + \frac{CI\%YR}{200}\right)^{1/6} - 1\right]$

N = total number of monthly payments
$CI\%YR$ = annual interest rate (as a percent)
PV = loan amount
PMT = monthly payment
FV = balloon payment

Odd-Period Calculations

$$PV\left[1 + i \times \frac{DAYS}{30}\right] =$$
$$-(1 + i \times S) \times PMT \times \left[\frac{1 - (1 + i)^{-N}}{i}\right] - FV(1 + i)^{-N}$$

Where:
- PV = loan amount
- i = periodic interest rate as a decimal
- $DAYS$ = actual number of days until the first payment
- PMT = periodic payment amount
- N = total number of payments
- FV = balloon payment amount
- S = 1 if $DAYS < 30$
- S = 0 if $DAYS \geq 30$

Advance Payments

$$PMT = \frac{-PV - FV(1 + i)^{-N}}{\left[\frac{1 - (1 + i)^{-(N - \#ADV)}}{i} + \#ADV\right]}$$

where:
- PMT = payment amount
- PV = loan amount
- FV = balloon payment amount
- i = periodic interest rate (as a decimal)
- N = total number of payments
- $\#ADV$ = number of payments made in advance

Modified Internal Rate of Return

$$MIRR = 100\left[\left(\frac{NFV_P}{-NPV_N}\right)^{1/n} - 1\right]$$

where:
- n = total number of compounding periods
- NFV_P = net future value of positive cash flows
- NPV_N = net present value of negative cash flows

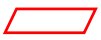
C

Menu Maps

The following maps show how to display each of the menus. There is a map for each menu label in the MAIN menu and for each menu found on the keyboard. The menu labels for variables are enclosed in boxes to illustrate how they are used:

Variable used to store and 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.

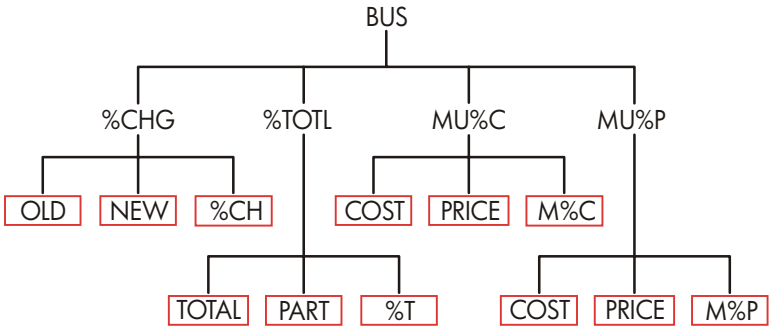


Figure C-1. BUS Menu

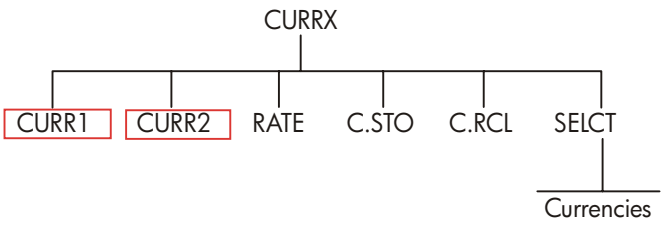


Figure C-2. CURRX Menu

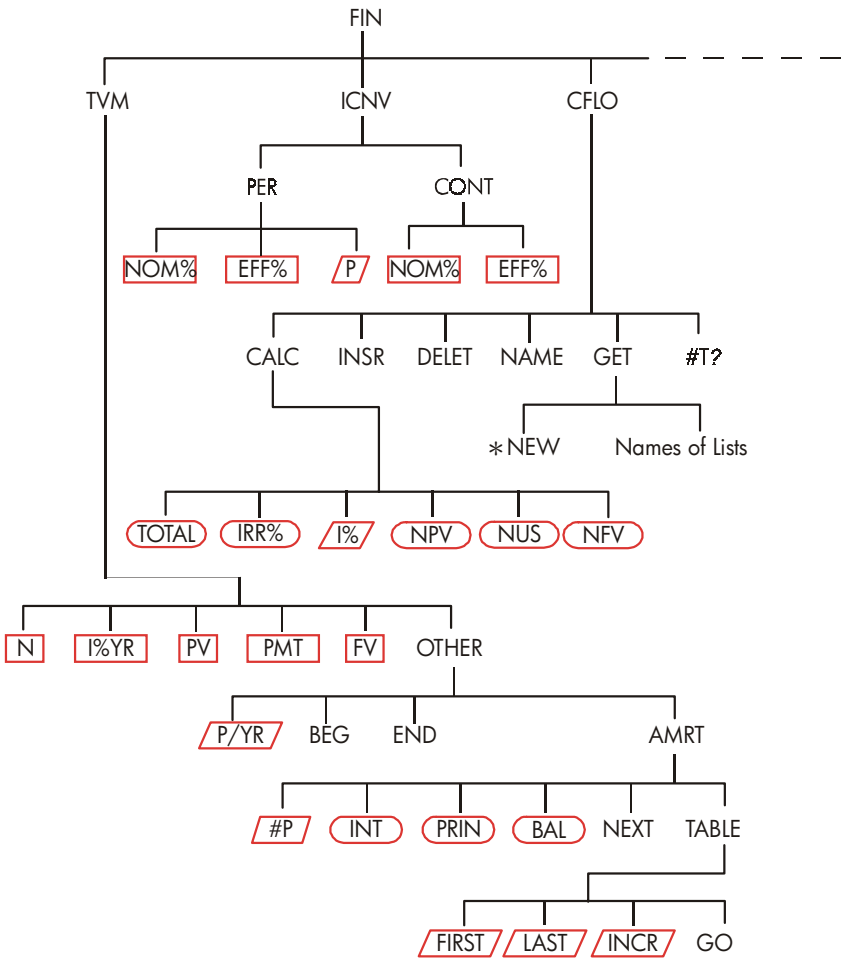


Figure C-3. FIN Menu

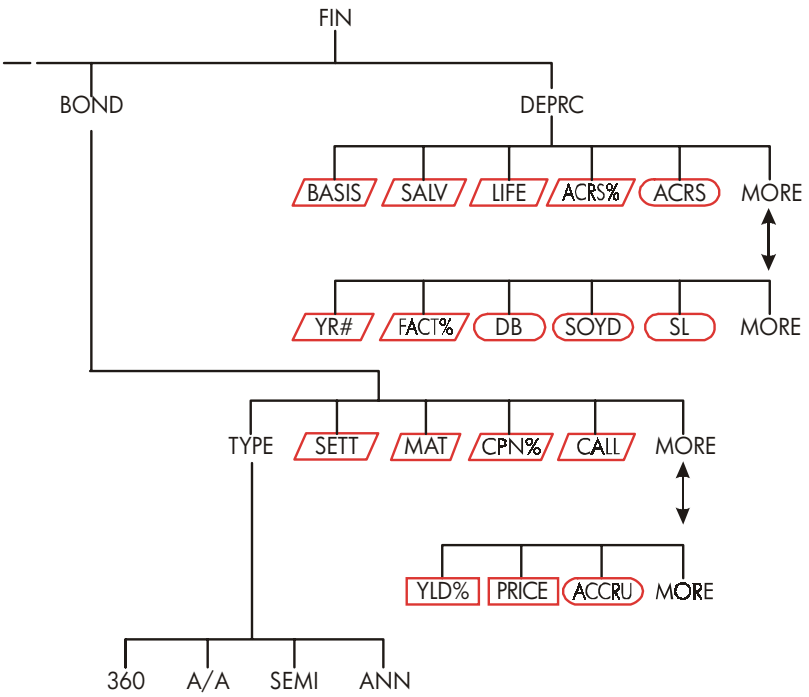


Figure C-3 (continued). FIN Menu

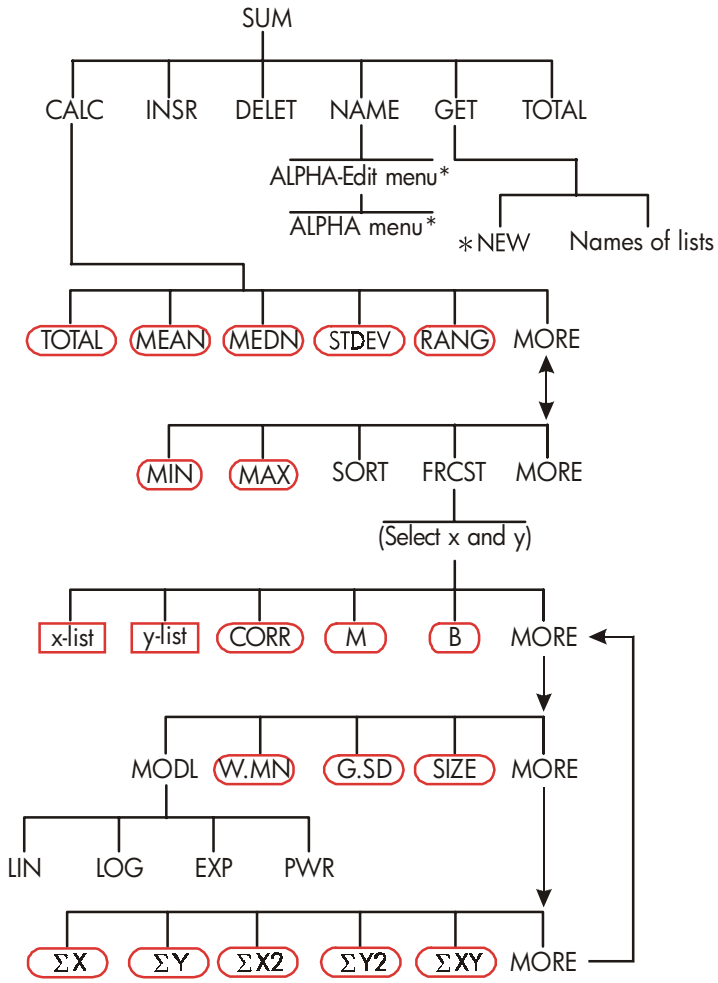


Figure C-4. SUM Menu

* For the complete menu, see pages 30-31.

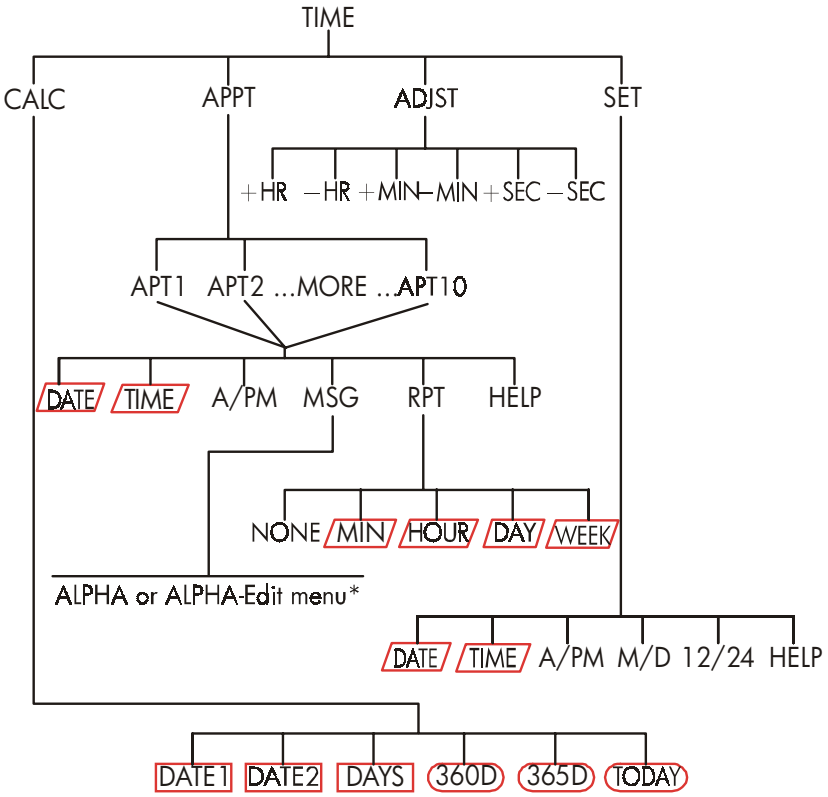


Figure C-5. TIME Menu

* For the complete menu, see pages 30-31.

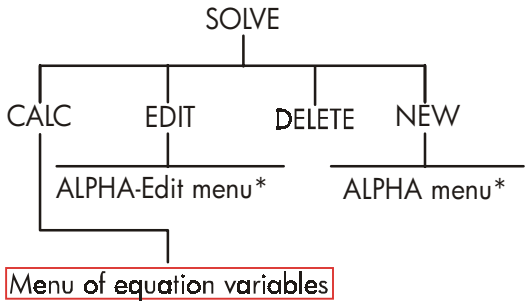


Figure C-6. SOLVE Menu

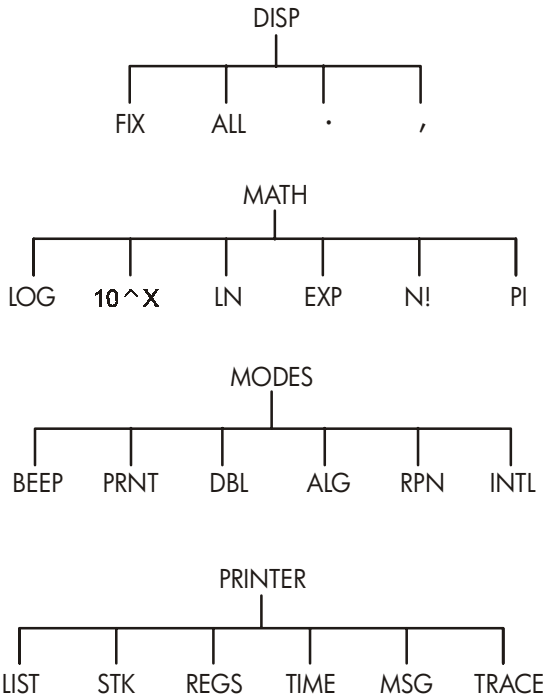


Figure C-7. DSP, MATH, MODES, and PRINTER Menus

* For the complete menu, see pages 30-31.

D

RPN: Summary

About RPN

The RPN appendixes (D, E, and F) are especially for those of you who want to use or learn *RPN*—Hewlett-Packard's original *Reverse Polish Notation* for operating calculators. This calculator can use *either* RPN *or* algebraic logic for calculations—you choose which.

HP's RPN operating logic is based on an unambiguous, parentheses-free mathematical logic known as "Polish Notation," developed by the Polish logician Jan Łukasiewicz (1878 – 1956). While conventional algebraic notation places the operators *between* the relevant numbers or variables, Łukasiewicz's notation places them *before* the numbers or variables. For optimal efficiency of the stack, we have modified that notation to specify the operators *after* the numbers. Hence the term *Reverse Polish Notation*, or *RPN*.

Except for the RPN appendixes, the examples and keystrokes in this manual are written entirely using Algebraic (ALG) mode.

About RPN on the hp 17bII+

This appendix replaces much of chapter 2, "Arithmetic." It assumes that you already understand calculator operation as covered in chapter 1, "Getting Started." Only those features unique to RPN mode are summarized here:

- RPN mode.
- RPN functions.
- RPN arithmetic, including percentages and [STO] and [RCL] arithmetic.

All other operations—including the Solver—*work the same in RPN and ALG modes*. (The Solver uses algebraic logic only.)

For more information about how RPN works, see appendix E, "RPN: The Stack." For RPN keystrokes of selected examples from chapter 14, see appendix F, "RPN: Selected Examples." Continue reading in chapter 2 to learn about the other functionality of your calculator.

Watch for this symbol in the margin earlier in the manual. It identifies keystrokes that are shown in ALG mode and must be performed differently in RPN mode. Appendixes D, E, and F explain how to use your calculator in RPN mode. The mode affects only arithmetic calculations—all other operations, including the Solver, work the same in RPN and ALG modes.

Setting RPN Mode

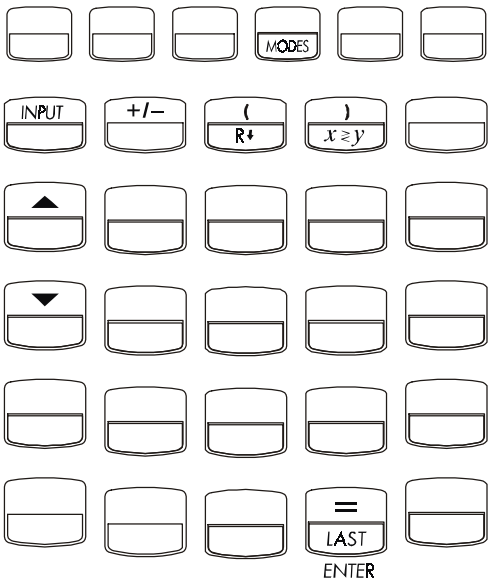
The calculator operates in either RPN (*Reverse Polish Notation*) or ALG (*Algebraic*) mode. This mode determines the operating logic used for arithmetic calculations.

To select RPN mode: Press ▬ MODES RPN.

The calculator responds by displaying `RPN MODE`. This mode remains until you change it. The display shows the X register from the stack.

To select ALG mode: Press ▬ MODES ALG. The calculator displays `ALGEBRAIC MODE`.

Where the RPN Functions Are



Function Name	Definition	Key to Use
ENTER	Enters and separates one number from the next.	[=]
LASTX	Recalls last number in X-register.	[LAST]
R ↓	Rolls down stack contents.	[R↓] (*same as* [(])
R ↑	Rolls up stack contents.	[▲] (except in lists)
X < > Y	X-register exchanges with Y-register.	[x≷y] (*same as* [)])
CHS	Changes sign.	[+/–]

Using INPUT for ENTER and ▼ for R↓. *Except in CFLO and SUM lists,* the [INPUT] key also performs the [ENTER] function and the [▼] key also performs the [R↓] function.

- In lists: [INPUT] stores numbers. Use [=] to enter numbers into the stack during arithmetic calculations.
- In lists: [▲] and [▼] move through lists. Use [R↓] to roll through stack contents.

Doing Calculations in RPN

Arithmetic Topics Affected by RPN Mode

This discussion of arithmetic using RPN replaces those parts of chapter 2 that are affected by RPN mode. These operations are affected by RPN mode:

- Two-number arithmetic ([+], [×], [−], [÷], [y^x]).
- The percent function ([%]).
- The LAST X function ([↓] [LAST]). See appendix E.

RPN mode does *not* affect the MATH menu, recalling and storing numbers, arithmetic done inside registers, scientific notation, numeric precision, or the range of numbers available on the calculator, all of which are covered in chapter 2.

Simple Arithmetic

Here are some examples of simple arithmetic. Notice that

- [ENTER] separates numbers that you key in.
- The operator ([+], [−], etc.) *completes* the calculation.
- One-number functions (such as [$\sqrt{x}$]) work the same in ALG and RPN modes.

To select RPN mode, press [MODES] RPN.

To Calculate:	Press:	Display:
12 + 3	12 [ENTER] 3 [+]	15.00
12 – 3	12 [ENTER] 3 [–]	9.00
12 x 3	12 [ENTER] 3 [×]	36.00
12 ÷ 3	12 [ENTER] 3 [÷]	4.00
12^2	12 [x^2]	144.00
$\sqrt{12}$	12 [$\sqrt{x}$]	3.46
1/12	12 [$1/x$]	0.08

You do not need to use [ENTER] before an operator, only *between keyed-in numbers*. Key in *both* numbers (separated by [ENTER]) before pressing the operator key.

The Power Function (Exponentiation). The power function uses the [y^x] keys.

To Calculate:	Press:	Display:
12^3	12 [ENTER] 3 [y^x]	1,728.00
$12^{1/3}$ (cube root)	12 [ENTER] 3 [$1/x$] [y^x]	2.29

The Percent Function. The [%] key calculates percentages *without* using the [×] key. Combined with [+] or [–], it adds or subtracts percentages.

To Calculate:	Press:	Display:
27% of 200	200 [ENTER] 27 [%]	54.00
200 less 27%	200 [ENTER] 27 [%] [–]	146.00
12% greater than 25	25 [ENTER] 12 [%] [+]	28.00

Compare these keystrokes in RPN and ALG modes:

	RPN Mode	ALG Mode
27% of 200	200 ENTER 27 %	200 × 27 % =
200 less 27%	200 ENTER 27 % −	200 − 27 % =

Calculations with STO and RCL

The store (STO) and recall (RCL) operations work identically in ALG and RPN modes (see "Storing and Recalling Numbers" and "Doing Arithmetic Inside Registers and Variables" in chapter 2). The keystrokes are the same for simple storing and recalling and for doing arithmetic *inside* registers and variables.

When doing arithmetic *in the display* with values from storage registers and variables, remember to use RPN. Compare these keystrokes in RPN and ALG modes:

	RPN Mode	ALG Mode
Store −2 x 3 in register 5	2 +/− ENTER 3 × STO 5	2 +/− × 3 = STO 5
Find *PV* − 2	FIN TVM RCL PV 2 −	FIN TVM RCL PV − 2 =
Find *PV* less 2%	FIN TVM RCL PV 2 % −	FIN TVM RCL PV − 2 % =
Find *PMT* x *N*	FIN TVM RCL PMT RCL N ×	FIN TVM RCL PMT × RCL N =

Chain Calculations—No Parentheses!

The speed and simplicity of calculating using RPN are apparent during *chain calculations*—longer calculations with more than one operation. The RPN memory stack (refer to appendix E) stores intermediate results until you need them, then inserts them into the calculation.

The cube root example and the percentage addition example (previous topics) are two simple examples of chain calculations.

For another example, calculate

$$7 \times (12 + 3)$$

Start the calculation inside the parentheses by finding 12 + 3. Notice that you don't need to press [ENTER] to save this intermediate result (15) before proceeding. Since it is a calculated result, it is saved automatically—*without using parentheses.*

Keys:	**Display:**	**Description:**
12 [ENTER] 3 [+]	15.00	Intermediate result.
7 [×]	105.00	Pressing the function key produces the answer.

Now study these examples. Note the automatic storage *and retrieval* of intermediate results.

To Calculate:	**Press:**	**Display:**
(750 x 12) ÷ 360	750 [ENTER] 12 [×] 360 [÷]	25.00
360 ÷ (750 x 12)	360 [ENTER] 750 [ENTER] 12 [×][÷]	0.04
	or	
	750 [ENTER] 12 [×] 360 [x≷y] [÷]	
{(456−75) ÷ 18.5}	456 [ENTER] 75 [−] 18.5 [÷] 68	
x (68 ÷ 1.9)	[ENTER] 1.9 [÷][×]	737.07
(3+4) x (5+6)	3 [ENTER] 4 [+] 5 [ENTER] 6 [+] [×]	77.00

E

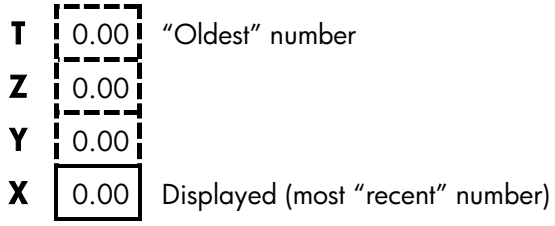
RPN: The Stack

This appendix explains how calculations take place in the automatic memory stack and how this method minimizes keystrokes in complicated calculations.

What the Stack Is

Automatic storage of intermediate results is the reason that RPN mode easily processes complicated calculations—without using parentheses. The key to automatic storage is the *automatic RPN memory stack*.

The memory stack consists of up to four storage locations, called *registers*, which are "stacked" on top of each other. It is a work area for calculations. These registers—labeled X, Y, Z, and T—store and manipulate four current numbers. The "oldest" number is the one in the T-(*top*) register.



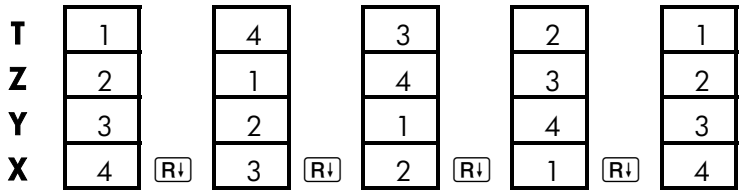
The most "recent" number is in the X-register: *This is the number you see in the display*.

Reviewing the Stack (Roll Down)

The R↓ (*roll down*) function (on the (key) lets you review the entire contents of the stack by "rolling" the contents downward, one register at a time. While in RPN mode you don't need to press the shift key for R↓.

The ▼ key has the same effect as R↓. except in a CFLO or SUM list, when ▼ affects the list and *not* the stack. Likewise, the ▲ key rolls the contents of the stack upward, except in lists.

Rolling a Full Stack. Suppose the stack is filled with 1, 2, 3, 4 (press 1 ENTER 2 ENTER 3 ENTER 4). Pressing R↓ four times rolls the numbers all the way around and back to where they started:



When you press R↓, the value in the X-register rotates around into the T-register. Notice that the *contents* of the registers are rolled, while the registers themselves maintain their positions. The calculator displays only the X-register.

Variable Stack Size. Clearing the stack by pressing ◒ CLR DATA reduces the stack to one register (X) with a zero in it. As you enter numbers, the stack builds up again. The R↓ and ▲ functions roll through as many registers as currently exist (one, two, three, or four).

Exchanging the X- and Y-Registers in the Stack

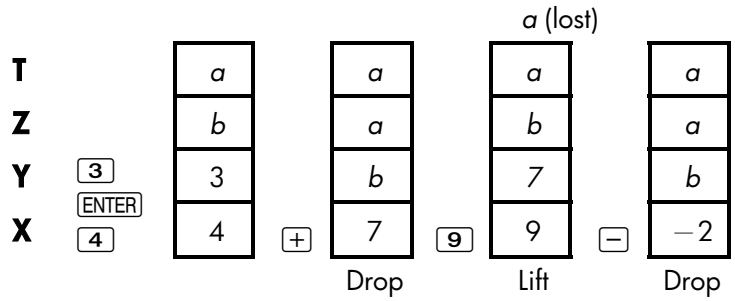
Another function that manipulates the stack contents is $x\leftrightarrow y$ (*x exchange y*), located on the) key. It swaps the contents of the X- and Y-registers without affecting the rest of the stack. Pressing $x\leftrightarrow y$ again restores the original order of the contents. While in RPN mode you don't need to press the shift key for $x\leftrightarrow y$.

The [x≷y] function is used primarily to swap the order of numbers in a calculation. For example, an easy way to calculate 9 ÷ (13x8) is to press 13 [ENTER] 8 [×] 9 [x≷y] [÷].

Arithmetic—How the Stack Does It

The contents of the stack move up and down automatically as new numbers enter the X-register (*lifting the stack*), and as operators combine two numbers to produce one new number in the X-register (*dropping the stack*). See how a full stack drops, lifts, and drops its contents while calculating

$$3 + 4 - 9 :$$



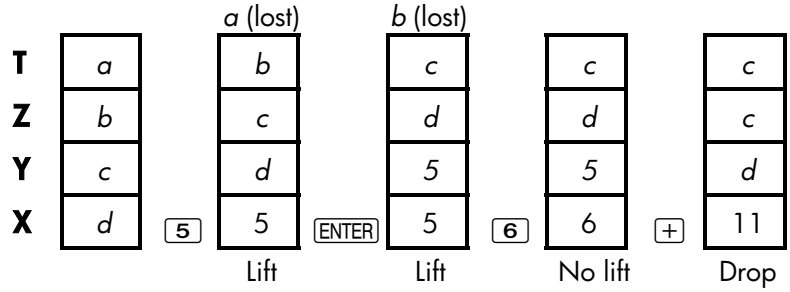
(*a* and *b* represent values already on the stack.)

- Notice that when the stack drops, it replicates the contents of the T-register and overwrites the X-register.
- When the stack lifts, it pushes the top contents out of the T-register, and that number is lost. This shows that the stack's memory is limited to four numbers for calculations.
- Because of the automatic movement of the stack, you do *not* need to clear the display before doing a new calculation.
- Most functions (except [ENTER] and [CLR]) prepare the stack to lift its contents *when the next number enters the X-register*.

How ENTER Works

You know that [ENTER] separates two numbers keyed in one after the other. In terms of the stack, how does it do this**?** Suppose the stack is filled with *a*, *b*, *c*, and *d*. Now enter and add two new numbers:

5 + 6 :



[ENTER] replicates the contents of the X-register into the Y-register. The next number you key in (or recall) *writes over* (instead of lifting) the copy of the first number left in the X-register. The effect is simply to separate two sequentially entered numbers.

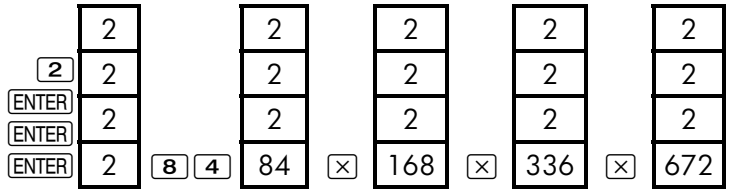
Using a Number Twice in a Row. You can use the replicating feature of [ENTER] to other advantages. To add a number to itself, key in the number and press [ENTER] [+].

Filling the Stack with a Constant. The replicating effect of [ENTER], together with the replicating effect (from T into Z) of stack drop, allows you to fill the stack with a numeric constant for calculations.

Example: Constant, Cumulative Growth. The annual sales of a small hardware company are projected to double each year for the next 3 years. If the current sales are $84,000, what are the annual sales for each of the next 3 years**?**

1. Fill the stack with the growth rate (2 [ENTER] [ENTER] [ENTER]).
2. Key in the current sales in thousands (84).

3. Calculate future sales by pressing [×] for each of the next 3 years.



Sales for the next 3 years are projected to be $168,000; $336,000; and $672,000.

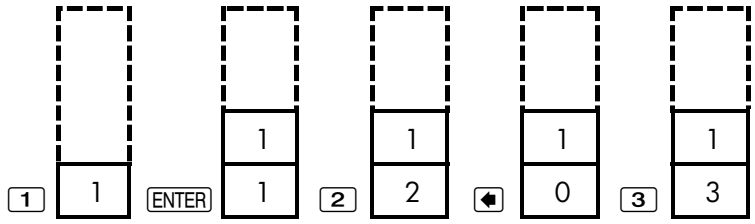
Clearing Numbers

Clearing One Number. Clearing the X-register puts a zero in it. The next number you key in (or recall) *writes over* this zero.

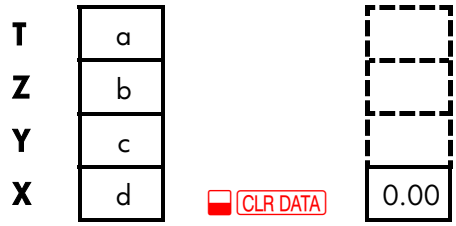
There are two ways to clear the number in the X-register:

- Press [←].
- Press [CLR].

For example, if you wanted to enter 1 and 3 but mistakenly entered 1 and 2, these keystrokes would correct it:



Clearing the Entire Stack. Pressing [CLR DATA] clears the X-register to zero and eliminates the Y-, Z-, and T-registers (reducing the size of the stack to one register). The stack expands again when you enter more numbers.



Because of the automatic movement of the stack, it is *not* necessary to clear the stack before starting a calculation. Note that if an application menu is currently displayed, pressing CLR DATA also clears the application's variables.

The LAST X Register

Retrieving Numbers from LAST X

The LAST X register is a companion to the stack: It stores the number that had been in the X-register *just before the last numeric operation* (such as a × operation). Pressing LAST returns this value to the X-register. This ability to recall the "last x" value has two main uses:

- Correcting errors: retrieving a number that was in the X-register just before an incorrect calculation.
- Reusing a number in a calculation.

Reusing Numbers

You can use LAST to reuse a number (such as a constant) in a calculation. Remember to enter the constant second, just before executing the arithmetic operation, so that the constant is the last number in the X-register, and therefore can be saved and retrieved with LAST.

Example: Calculate $\frac{96.74+52.39}{52.39}$

Keys:	Display:	Description:
96.74 [ENTER]	96.74	
52.39 [+]	149.13	Intermediate result.
[LAST]	52.39	Retrieves the number before the [+] operation, saved in LAST X.
[÷]	2.85	Final result.

Chain Calculations

The automatic lifting and dropping of the stack's contents let you retain intermediate results without storing or reentering them, and without using parentheses. This is an advantage the RPN stack has over algebraic calculator logic. Other features of RPN include the following:

- You never work with more than two numbers at a time.
- [ENTER] separates two numbers keyed in sequentially.
- Pressing an operator key executes that operation immediately.
- Intermediate results appear as they are calculated, so you can check each step as you go.
- Intermediate results are automatically stored. They reappear automatically as they are needed for the calculation—the last result stored is the first to come back out.
- You can calculate in the same order as you would with pencil and paper—that is, from the innermost parentheses outward:

  $$4 \div [14 + (7 \times 3) - 2] = 0.12$$

  can be solved as 7 [ENTER] 3 [×] 14 [+] 2 [−] 4 [x≷y] [÷]

Exercises

Here are some extra problems that you can do to practice using RPN.

Calculate: (14 + 12) x (18 – 12) ÷ (9 – 7)=78.00
A Solution: 14 ENTER 12 + 18 ENTER 12 − × 9 ENTER 7 − ÷

Calculate: $23^2 -$ (13 x 9) + $^1/_7$=412.14
A Solution: 23 x^2 13 ENTER 9 × − 7 $1/x$ +

Calculate: $\sqrt{(5.4\times0.8)\div(12.5-0.7^3)} = 0.60$

A Solution: 5.4 ENTER .8 × .7 ENTER 3 y^x 12.5 $x\geq y$ − ÷ $\sqrt{x}$
or
5.4 ENTER .8 × 12.5 ENTER .7 ENTER 3 y^x − ÷ $\sqrt{x}$

Calculate: $\sqrt{\dfrac{8.33\times(4-5.2)\div[(8.33-7.46)\times0.32]}{4.3\times(3.15-2.75)-(1.71\times2.01)}} = 4.57$

A Solution: 4 ENTER 5.2 − 8.33 × LAST 7.46 − .32 × ÷
3.15 ENTER 2.75 − 4.3 × 1.71 ENTER 2.01 × − ÷ $\sqrt{x}$

F

RPN: Selected Examples

The following examples selected from chapter 14 ("Additional Examples") have been converted to RPN keystrokes. These examples illustrate how to convert algebraic to RPN keystrokes in less common situations: with [%], with [RCL], and in a CFLO list.

Example: Simple Interest at an Annual Rate. Your good friend needs a loan to start her latest enterprise and has requested that you lend her $450 for 60 days. You lend her the money at 7% simple annual interest, to be calculated on a 365-day basis. How much interest will she owe you in 60 days, and what is the total amount owed**?**

Keys:	**Display:**	**Description:**
450 [ENTER] 7 [%]	31.50	Annual interest.
60 [×] 365 [÷]	5.18	Actual interest for 60 days.
450 [+]	455.18	Adds principal to get total debt.

Example: APR for a Loan with Fees. A borrower is charged two points for the issuance of a mortgage. (One point is equal to 1% of the mortgage amount.) If the mortgage amount is $60,000 for 30 years and the interest rate is 11½% annually with monthly payments, what APR is the borrower paying**?**

1. Since the payment amount is not given, calculate it (*PMT*) first. Use the given mortgage amount (*PV* = $60,000) and interest rate (*I%YR* = 11½%).

2. To find the APR (the new *I%YR*), use the *PMT* calculated in step 1 and

adjust the mortgage amount to reflect the points paid (*PV* = $60,000 −2%). All other values remain the same (term is 30 years; no future value).

Keys:	**Display:**	**Description:**
FIN TVM OTHER (−) CLR DATA EXIT	12 P/YR END MODE	If necessary, sets 12 payments per year and End mode.
30 (−) N	N=360.00	Figures and stores number of payments.
11.5 I%YR		Stores interest rate and
60000 PV	PV=60,000.00	amount of loan.
0 FV	FV=0.00	No balloon payment, so future value is zero.
PMT	PMT=−594.17	Borrower's monthly payment.
RCL PV		Stores actual amount of
2 % (−) PV	PV=58,800.00	money received by borrower into *PV*.
I%YR	I%YR=11.76	Calculates APR.

Example: Loan from the Lender's Point of View. A $1,000,000 10-year, 12% (annual interest) *interest-only* loan has an origination fee of 3 points. What is the yield to the lender**?** Assume that monthly payments of interest are made. (Before figuring the yield, you must calculate the monthly *PMT* = (*loan* x 12%) ÷ 12 mos.) When calculating the *I%YR*, the *FV* (a balloon payment) is the entire loan amount, or $1,000,000, while the *PV* is the loan amount minus the points.

Keys:	Display:	Description:
FIN TVM OTHER CLR DATA EXIT	12 P/YR END MODE	If necessary, sets 12 payments per year and End mode.
10 N	N=120.00	Stores total number of payments.
1000000 ENTER 12 %	120,000.00	Calculates annual interest on $1,000,000.
12 ÷ PMT	PMT=10,000.00	Calculates, then stores, monthly payment.
1000000 FV	FV=1,000,000.00	Stores entire loan amount as balloon payment.
3 % − +/− PV	PV=-970,000.00	Calculates, then stores, amount borrowed (total - points).
I%YR	I%YR=12.53	Calculates APR—the yield to lender.

Example: Savings for College. Your daughter will be going to college in 12 years and you are starting a fund for her education. She will need $15,000 at the beginning of each year for four years. The fund earns 9% annually, compounded monthly. You plan to make monthly deposits, starting at the end of the current month. How much should you deposit each month to meet her educational expenses**?**

See figures 14-1 and 14-2 (chapter 14) for the cash-flow diagrams.

Remember to press the = key for ENTER while working in a list. (Pressing INPUT will add data to the list, not perform an ENTER.)

Keys:	Display:	Description:
FIN CFLO		Displays current cash-flow list and CFLO menu keys.
CLR DATA YES		Clears current list or gets a new one.
or		
GET #NEW	FLOW(0)=?	

Step 1: Set up a CFLO list.

Keys:	Display:	Description:
0 INPUT	FLOW(1)=?	Sets initial cash flow, *FLOW(0)*, to zero.
0 INPUT	#TIMES(1)=1	Stores zero in *FLOW(1)* and prompts for the number of times it occurs.
12 ENTER 12 × 1 − INPUT	FLOW(2)=?	*For* ENTER, *press* =, *not* INPUT. Stores 143 (for 11 years, 11 months) in *#TIMES(1)* for *FLOW(1)*.
15000 INPUT	#TIMES(2)=1	Stores amount of first withdrawal, at end of 12th year.
INPUT	FLOW(3)=?	
0 INPUT	#TIMES(3)=1	Stores cash flows of zero ...
11 INPUT	FLOW(4)=?	... for the next 11 months.
15000 INPUT INPUT	FLOW(5)=?	Stores second withdrawal, for sophomore year.

0 INPUT 11 INPUT	FLOW(6)=?	Stores cash flows of zero for the next 11 months.
15000 INPUT INPUT	FLOW(7)=?	Stores third withdrawal, for junior year.
0 INPUT 11 INPUT	FLOW(8)=?	Stores cash flows of zero for the next 11 months.
15000 INPUT INPUT	FLOW(9)=?	Stores fourth withdrawal, for senior year.
EXIT CALC	NPV, NUS, NFV NEED I%	Done entering cash flows; gets CALC menu.

Step 2: Calculate *NUS* for the monthly deposit. Then calculate net present value.

Keys:	**Display:**	**Description:**
9 ENTER 12 ÷		Figures the periodic
I%	I%=0.75	(monthly) interest rate and stores it in *I%*.
NUS	NUS=182.30	Amount of monthly deposit needed to meet planned withdrawals.
NPV	NPV=17,973.48	Calculates the net present value of the monthly deposits, which is the same as the NPV of the four future withdrawals.

Example: Tax-Free Account. Consider opening an IRA account with a dividend rate of 8.175%. 1) If you invest $2,000 at the beginning of each year for 35 years, how much will you have at retirement**?** 2) How much will you have paid into the IRA**?** 3) How much interest will you have earned**?** 4) If your post-retirement tax rate is 15%, what is the

after-tax future value of the account**?** Assume only the interest will be taxed (the principal was taxed before deposit). 5) What is the purchasing power of that amount, in today's dollars, assuming an 8% annual inflation rate**?**

Keys:	**Display:**	**Description:**
FIN TVM OTHER 1 P/YR BEG EXIT	1 P/YR BEGIN MODE	Sets 1 payment per year and Begin mode.
35 N	N=35.00	Stores number of payment periods until retirement (1 x 35).
8.175 I%YR	I%YR=8.18	Stores dividend rate.
0 PV	PV=0.00	Present value of account (before first payment).
2000 +/- PMT	PMT=-2,000.00	Annual payment (deposit).
FV	FV=387,640.45	Calculates amount in account at retirement.
RCL PMT RCL N ×	-70,000.00	Calculates total amount paid into IRA by retirement.
RCL FV +	317,640.45	Calculates interest you will earn.
15 %	47,646.07	Taxes at 15% of interest.
+/- RCL FV +	339,994.39	Subtracts taxes from total *FV* to calculate after-tax *FV*.
FV	FV=339,994.39	Stores after-tax future value in *FV*.

8 I%YR 0 PMT PV	PV=-22,995.36	Calculates present-value purchasing power of the above after-tax *FV* at 8% inflation rate.

Example: Taxable Retirement Account. If you invest $3,000 each year for 35 years, with dividends taxed as ordinary income, how much will you have in the account at retirement**?** Assume an annual dividend rate of 8.175% and a tax rate of 28%, and that payments begin today. What will be the purchasing power of that amount in today's dollars, assuming 8% annual inflation**?**

Keys:	**Display:**	**Description:**
FIN TVM		Displays TVM menu.
OTHER 1 P/YR		Sets 1 payment per year
BEG EXIT	1 P/YR BEGIN MODE	and Begin mode.
35 N	N=35.00	Stores years until retirement.
8.175 ENTER 28 % −	5.89	Calculates interest rate diminished by tax rate.
I%YR	I%YR=5.89	Stores interest rate.
0 PV	PV=0.00	Stores no present value.
3000 +/- PMT	PMT=-3,000.00	Stores annual payment.
FV	FV=345,505.61	Calculates future value.
8 I%YR 0 PMT PV	PV=-23,368.11	Calculates present-value purchasing power of the above *FV* at 8% inflation.

Error Messages

The calculator beeps and displays an error message under certain circumstances—for example, when you attempt an operation that is not allowed.

The calculator distinguishes between math errors that occur on the calculator line and other types of messages by preceding math-error messages with the word ERROR:.

Press CLR or ◀ to erase the message and restore the previous display.

BAD GUESSES:
PRESS [CLR] TO VIEW
The Solver cannot begin a numerical search using the initial estimates. See pages 180 and 239.

BATT TOO LOW TO PRINT
To conserve battery power, the calculator will not transmit data to the printer until fresh batteries have been installed.

CURRENT LIST UNNAMED:
NAME OR CLEAR THE LIST
Attempted to get another list without first clearing or naming the current list. Press ↓ CLR DATA to clear it or NAME to name it.

EMPTY LIST
Attempted a calculation using an empty CFLO or SUM list.

ERROR: LOGARITHM(NEG)
ERROR: LOGARITHM(0)

Attempted to take the base 10 or natural log of a negative number or zero. This can happen during curve-fitting calculations if you attempt to calculate:

- A logarithmic forecasting model with a negative or zero *x*-value.
- An exponential model with a negative or zero *y*-value.
- A power model with a negative or zero *x*- or *y*-value.

`ERROR: NEG^NONINTEGER`
Attempted to raise a negative number to a non-integer power.

`ERROR: OVERFLOW`
An internal result in a calculation was too large for the calculator to handle.

`ERROR: SQRT(NEG)`
Attempted to take the square root of a negative number or calculate *G.SD* given any negative frequencies.

`ERROR: UNDERFLOW`
An internal result in a calculation was too small for the calculator to handle.

`ERROR: 0^NEG`
Attempted to raise zero to a negative power.

`ERROR: 0÷0`
Attempted to divide zero by zero.

`ERROR: 0^0`
Attempted to raise zero to the zero power.

`ERROR: ÷0`
Attempted to divide by zero.

`INPUTS CAUSED ÷0`

The numbers stored into built-in variables caused a division by zero in the calculation. You must change one or more stored values. (Refer to the equations in appendix B to see which variables appear in the divisor.)

`INSUFFICIENT DATA`

- Attempted to calculate standard deviation with only one value in the list.
- Attempted to do curve fitting using an *x*-variable list in which all the values are equal.
- Attempted to do curve fitting using the logarithmic or power models with a list for which the transformed values of *x* (ln *x*) are equal.

`INSUFFICIENT MEMORY`

The calculator has insufficient memory available to do the operation you've specified. Refer to "Managing Calculator Memory" on page 227 for additional information.

`INTEREST <= -100%`

One of the following values for interest is less than or equal to −100:

- TVM menu: *I%YR* ÷ *P/YR*.
- PER menu: *NOM%* ÷ *P* (calculating *EFF%*); *EFF%* (calculating *NOM%*).
- CONT menu: *EFF%*.
- CFLO menu: *I%* (calculating *NPV*, *NUS*, or *NFV*) or estimate of *IRR%*.

`INTERRUPTED`

Calculation of *I%YR*, *IRR%*, amortization results, a Solver variable, or a SUM-list sort was interrupted.

`INVALID DATE`

- The number entered cannot be interpreted as a proper date. Check its format (page 143).
- Attempted to set a date outside the range 1/1/2000 through 12/31/2099, or attempted date arithmetic outside the range 10/15/1582 through 12/31/9999.

INVALID EQUATION

- The Solver cannot interpret the equation due to a syntax error. Refer to "What Can Appear in an Equation," page 166.
- A variable's name is invalid. Refer to "Names of Variables," page 166.

INVALID INPUT

- Attempted 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 appointment's repeat interval is out of range.
- Attempted to enter a non-integer, negative number when specifying the number of displayed decimal places (in DSP).

INVALID N

Attempted to calculate *I%YR* with $N \leqq 0.99999$ or $N \geqq 10^{10}$.

IRR% > 0 EXISTS; KEY
IN GUESS; [STO] ⟨IRR%⟩

Calculation of *IRR%* produced a negative answer, but the calculator has determined that there is also a unique positive answer. (Refer to page 238.)

MACHINE RESET

The calculator has been reset (page 224, 228).

MANY OR NO SOLUTIONS

The calculator 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 to calculate *IRR%*.

MANY/NO SOLUTIONS; KEY
IN GUESS; [STO] (IRR%)
The calculation of *IRR%* is complex, and requires you to store a guess. (Refer to page 238.)

MEMORY LOST
Continuous Memory has been erased (page 224, 230).

NAME RLREADY USED:
TYPE A NAME; [INPUT]
The list name you've attempted to enter is already in use; type in a new name and press [INPUT].

NO SOLUTION
No solution is possible using the values stored in the current built-in menu or list. This most commonly results from an incorrect sign for a cash flow or other monetary value. (Review page 64.)

N! N<0 OR N NONINTEGER
Attempted to calculate the factorial of a negative or non-integer value.

OVERFLOW
A warning—*not an error*—that the magnitude of a result is too large for the calculator to handle, so it returns ±9.99999999999E499 rounded to the current display format. See page 47 for limits.

SOLUTION NOT FOUND

No solution was found for a Solver equation using the current values stored in its variables. Refer to page 246 in appendix B.

UNDERFLOW
A warning—*not an error*—that the magnitude of a result is too small for the calculator to handle, so it returns the value zero. See page 47 for limits.

UNEQUAL LIST LENGTHS
Attempted a two-list SUM calculation using lists of unequal lengths.

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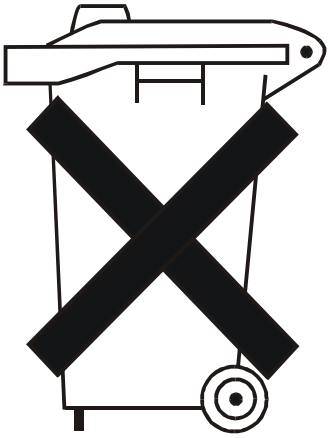

Batteries are delivered with this product, when empty do not throw them away but collect as small chemical waste.

Bij dit produkt zijn batterijen geleverd. Wanneer deze leeg zijn, moet u ze niet weggooien maar inleveren als KCA.