HEWLETT-PACKARD

HP-12C

TRAINING GUIDE

HP-12C

Training Guide

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"Explain all that," said the Mock Turtle.
"No, no! The adventures first," said the Gryphon in an impatient tone: "explanations take such a dreadful time."

Lewis Carroll

Contents

Introduction

The HP-12C Training Guide consists of twelve chapters designed to give you the knowledge you need to feel at ease with your calculator. The more confidence you have in your HP-12C calculator and the better you understand it, the more profitably you will use it. Remember, YOU CANNOT HURT THE HP-12C, even by pressing improper key sequences.

Each chapter is followed by a summary and a review test. The answer to each question is available so that you can check your work. These summaries and tests will help fix in your mind the new ideas presented in each chapter. They will also point out topics requiring more study.

After reading through this training guide and working the examples it contains, you will be able to:

* Calculate mortgage payments
* Calculate loan amounts
* Calculate balloon payments
* Calculate interest rates and yields
* Do amortization schedules
* Determine an investment's internal rate of return
* Write and run a program

And much more.

Don't be afraid of the HP-12C's programming capabilities. A program is nothing more than a sequence of manual keystrokes that is remembered by the calculator. The HP-12C is so easy to program and use that it requires no prior programming experience. The calculator performs the drudgery, saving time, and leaving your mind free for more creative work.

We want you to feel comfortable with your HP-12C and we want to show you how easy it is to use. So turn the page and let's begin.

Chapter 1

Getting Started

Preview

In Chapter 1 you will:

* Key numbers into the HP-12C.
* Perform simple arithmetic and chain calculations.
* Store numbers for use at a later time.
* Discover alternate functions.

> Relax, you cannot hurt the HP-12C, even by pressing improper key sequences.

As you complete each of the following steps, check it off so that you can easily find your place.

() 1. To begin, press [ON]. If the display does not show 0.00, press [CLx] and you'll be ready to begin.* (More about [CLx] later.) Pressing [ON] again turns the calculator off.

() 2. If you are not using the calculator, the HP-12C will automatically turn itself off in about 10 minutes to save the batteries. But don't worry - any information you have keyed into the calculator is saved in its Continuous Memory. Simply press [ON] and continue.

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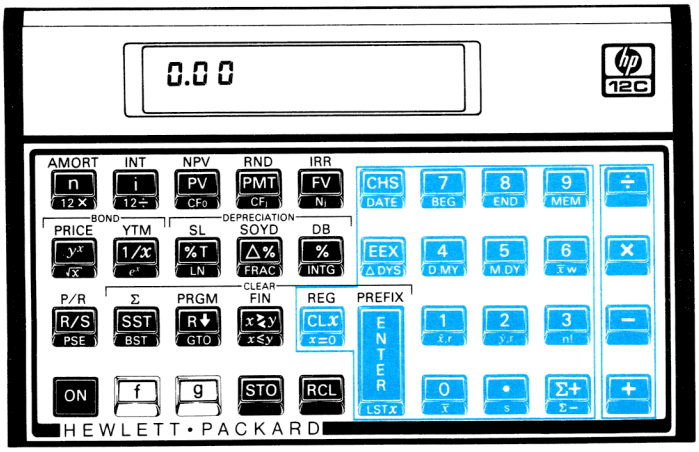
* If you do not see two zeroes to the right of the decimal point press and release the gold [f] key, and then press the 2 key. If a comma is placed where the decimal point should be, turn the calculator off, then press and hold down the [.] key while you press and release [ON].

Keying in Numbers

() 3. The keys on the right half of the keyboard are the digit entry and arithmetic keys.



Arithmetic Keys

Digit Entry Keys

Some Key Locations

Figure 1

() 4. Key in the number 1234567.89, pressing the digit entry keys in the same sequence that you would write the number on a piece of paper. Don't forget to key in the decimal point. If you make a mistake keying in this number, press [CLx] and try again.

() 5. The display should look like this:

1,234,567.89

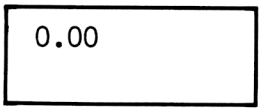
() 6. Notice the commas which are now in the display. The HP-12C automatically adds commas to make reading large numbers easy.

() 7. Press [CHS] (change sign) and see:

-1,234,567.89

The display now contains a negative number. Press [CHS] again to remove the minus sign, making the number positive.

() 8. Now clear the display by pressing [CLx] and see:



Clear X ([CLx]) clears only the display (also called the X-register). There are several other clearing functions in the HP-12C which you will learn about later.

Simple Arithmetic

() 9. Press the following keys to add the numbers 13 and 8.

Keystrokes	Display	
13	13.	
[ENTER]	13.00	
8	8.	
[+]	21.00	The answer!

()10. Simple arithmetic involves two numbers and an operation -- addition, subtraction, multiplication, or division. To do such a calculation on your HP-12C, first key the two numbers into the calculator, and then tell the calculator the operation to be performed.

()11. The two numbers are separated by the [ENTER] key. After keying in the first number, press [ENTER] to tell the calculator that you have completed "entering" the number.

()12. To perform an arithmetic operation:

1. Key in the first number.
2. Press [ENTER] to separate the second number from the first.
3. Key in the second number.
4. Press [+], [-], [x], or [/]* to perform the operation.

()13. Notice that you don't have to press [CLx] before keying in the next example. The first number you will press in step 14 (the number 7) will move the old number automatically and at the same time put a 7 in the display.

()14. Example: Add the numbers -7 and 9.

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* The divide key is represented by [/].

Keystrokes	Display	
7	7.	The first number is keyed into the calculator.
[CHS]	-7.	The first number is negative.
[ENTER]	-7.00	The first number is separated from the second -- digit entry is terminated.
9	9.	The second number is keyed in.
[+]	2.00	The answer is calculated.

()15. Now try the next example. Calculate 15 / 3 as follows:

Keystrokes	Display	
15	15.	The first number is keyed into the calculator.
[ENTER]	15.00	The first number is separated from the second -- digit entry is terminated.
3	3.	The second number is keyed in.
[/]	5.00	The answer is calculated.

()16. Press the following keys to subtract 2 from the previous result.

Keystrokes	Display	
2	2.	The second number is keyed in.
[-]	3.00	The answer is calculated.

Once an answer has been calculated and is in the display, you can perform another operation with this number by keying in the second number and pressing the operation key.

()17. Notice that you did not press [ENTER] to separate the second number from the first. The reason is that the result of the prior calculation is stored inside the calculator.

()18. The only time you must press the [ENTER] key to separate two numbers is when you are keying them both in, one immediately following the other.

()19. The HP-12C is designed so that each time you press an arithmetic key ([+], [-], [x], or [/]), the calculator performs the operation immediately --- not later --- so that you see the result of each calculation as it is performed.

Chain Calculations

()20. Suppose you've written three checks without updating your checkbook, and you've just deposited your paycheck for $1057.30 into your checking account. If your last balance was $107.45 and the checks were written for $21.98, $30.24, and $9.16, what is the new balance?

Solution: When written down on paper, this problem would read:

$$107.45 - 21.98 - 30.24 - 9.16 + 1057.30 = ?$$

Keystrokes	Display	
107.45	107.45	The first number is keyed in.
[ENTER]	107.45	The first number is separated from the second.
21.98	21.98	The second number is keyed in.
[-]	85.47	Pressing [-] subtracts the second number from the first. The result is the balance after subtracting the first check.
30.24	30.24	The next number is keyed in. Since a calculation has just been performed, it is not necessary to press [ENTER].
[-]	55.23	The amount of the second check is subtracted. The display shows the new balance.
9.16 [-]	46.07	The next check is keyed in and subtracted from the previous balance.
1057.30 [+]	1,103.37	The paycheck deposited is added to the previous balance. The current balance appears in the display.

()21. Now let's try a different type of calculation --- one which involves multiplying groups of two numbers and then adding the results. This type of calculation would be required to total an invoice that lists several items with different quantities and different prices. Consider the calculation of (3 x 5) + (7 x 6). If you were doing this calculation on paper, you would do the multiplication in the first parentheses ①, then the multiplication in the second parentheses ②, and then add the two results together for the final result ③:

① ②
(3 x 5) + (7 x 6)

15 + 42

③
57

()22. The HP-12C calculates the answer in the same way:

Keystrokes	Display	
3 [ENTER] 5 [x]	15.00	The numbers in the first parentheses are multiplied.
7 [ENTER] 6 [x]	42.00	The numbers in the second parentheses are multiplied.
[+]	57.00	The two multiplication results are added for the final result. (The HP-12C remembered the 15.00.)

()23. Here's another problem:

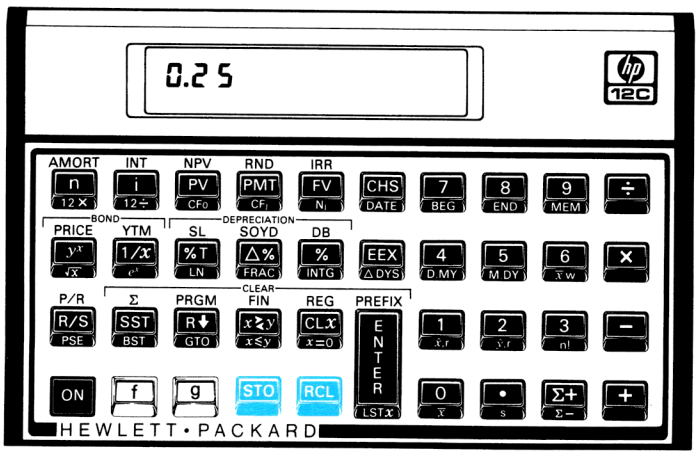
$$\frac{25 - 17}{13 + 19}$$

Keystrokes	Display	
25 [ENTER] 17 [-]	8.00	The numbers in the top portion of the fraction are subtracted.
13 [ENTER] 19 [+]	32.00	The numbers in the bottom portion of the fraction are added.
[/]	0.25	The two previous results are divided to obtain the answer.

Storage Registers

()24. Numbers, or data, in the HP-12C are stored in memories called "storage registers" or, simply, "registers." Four special registers are used for storing numbers during calculations. (You have been using these registers, called "stack registers," in the previous examples.)

()25. In addition to these registers, into which numbers are stored automatically, up to 20 "data storage registers" are available for you to store numbers. These data storage registers are designated Register 0 (R0) through Register 9 (R9) and Register .0 (R.0) through Register .9 (R.9). Store ([STO]) and recall ([RCL]) will be used to access these storage registers.



Locations of [STO] and [RCL]

Figure 2

()26. Still other storage registers -- the "financial registers" -- are available, although they are usually used only for financial calculations. You will learn about the financial registers ([n], [i], [PV], [PMT], [FV]) in Chapter 3.

()27. Perform the following operations:

Keystrokes	Display	
146	146.	
[STO] 5	146.00	146 is stored in R5.
321	321.	
[STO] [.] 3	321.00	321 is stored in R.3.

To store a number showing in the display into a data storage register:

1. Press [STO] (store).
2. Key in the register number:
   0 through 9 or [.] 0 through [.] 9.

()28. Now press these keys:

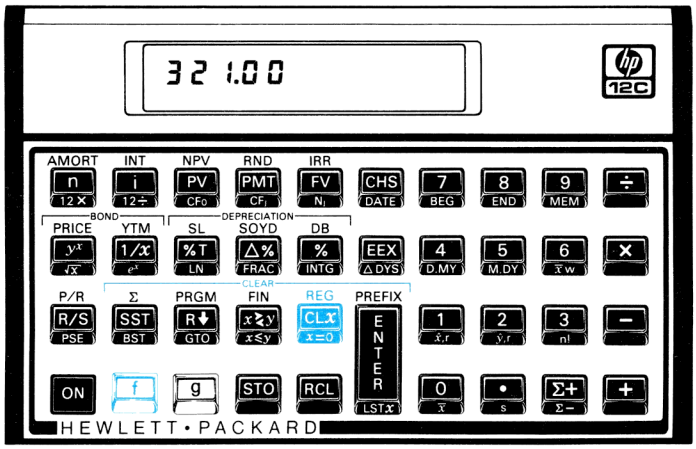
Keystrokes	Display	
[RCL] 5	146.00	146 is recalled from R5.
[RCL] [.] 3	321.00	321 is recalled from R.3.

To recall a number from a storage register into the display, press [RCL] (recall), and then key in the appropriate register number. This copies the number from the storage register into the display; the number remains unaltered in the storage register until a new number is stored there, until the register is added to or subtracted from, or until the storage registers are cleared. And, when a value is recalled from a storage register, the number previously in the display is automatically held in the calculator --- ready for a calculation.

()29. A single storage register can be cleared by storing zero in it. For example, clear register 5.

Keystrokes	Display	
0 [STO] 5	0.00	Zero is stored in R5.
[RCL] [.] 3	321.00	Register [.] 3 remains undisturbed.

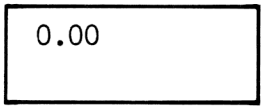
()30. All registers may be cleared at one time. Press the gold [f] key then release it. Next press [CLx] and release it. These keystrokes are normally written [f] CLEAR [REG]. The word CLEAR in gold above the five bracketed keys means that when the gold [f] key is pressed (and released) before one of the bracketed keys is pressed, the indicated registers (or PREFIX) --- printed in gold above each key --- are (is) cleared.



Location of [f] CLEAR [REG]

Figure 3

()31. The display now shows:



Notice that you cleared all of the registers, including the stack registers (see step 24). Since the display is one of the four stack registers, the contents of the display, 321.00, was cleared, leaving 0.00.

Alternate Functions

()32. This is probably the first time that you have used [f] --- a prefix key. Many keys on the HP-12C perform two or three different functions. The main function of a key is printed in white on the face of the key. The alternate (or shifted) functions of a key are printed in gold above the key and in blue on the lower face of the key. These alternate (shifted) functions are specified by pressing and releasing the appropriate prefix key (either the gold [f] key or the blue [g] key) before pressing the function key.

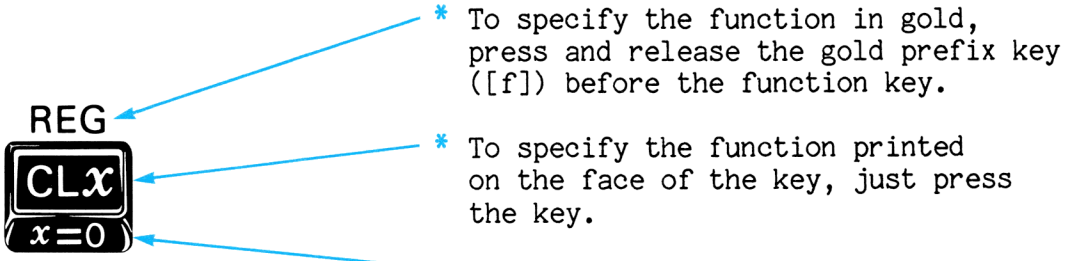
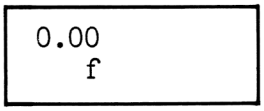


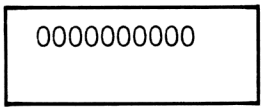
Figure 4

()33. Press [f] and see:

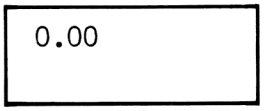


Pressing the [f] prefix key turns on an "annunciator" -- f -- in the bottom of the display. Likewise, a "g" appears in the bottom of the display when the [g] prefix key is pressed.

()34. If you press the [f] or [g] prefix key by mistake, you can easily cancel it by using the clear prefix function. Press [f] CLEAR [PREFIX] and first see:



and then, in about one second, see:



What you saw briefly was the complete contents of the display, all ten digits. This is useful in some work, but you won't be using this feature in this course. If you're curious to learn more about this ten digit display, see Mantissa Display Format in Section 5 of your HP-12C Owner's Handbook and Problem-Solving Guide.

Chapter 1 Summary

* The digit entry keys are used to key in numbers just as you would write them down. Reference: Page 1-3, steps 3-4.

* [CHS] is used to key in a negative number. Reference: Page 1-3, step 7.

* [CLx] clears the display. Reference: Page 1-4, step 8.

* [ENTER]: The [ENTER] key is used to separate two numbers. Reference: Page 1-4, steps 10-12.

* When an arithmetic key is pressed, the HP-12C performs the operation immediately. Reference: Page 1-6, step 19.

* The results of prior calculations are stored inside the calculator and do not have to be re-entered. Reference: Page 1-5, steps 17-18.

* [STO]: Numbers are stored in storage registers with the [STO] key. Reference: Page 1-8, steps 24-27.

* [RCL]: Numbers are recalled from storage registers with the [RCL] key. Reference: Page 1-9, steps 28-29.

* Twenty data storage registers designated R0 - R9 and R.0 - R.9 are available. Reference: Page 1-8, step 25.

* [f] CLEAR [REG] clears all storage registers. Reference: Pages 1-9 - 1-10, steps 30-31.

* The [f] and [g] prefix keys are used to access the alternate (shifted) functions on the HP-12C. Reference: Page 1-10, step 32.

Review Test for Chapter 1

The answers are on Page 1-15, immediately following this review test.

A NOTE ABOUT REVIEW TESTS:

All of the review tests are intended to help you learn, not to find out whether you pass or fail. Make a good effort to solve each problem. If you get lost, relax. Check the answer, and if the solution does not seem clear to you, review the referenced step(s) in the chapter and try the problem again. Make an effort to understand the material in each chapter before proceeding. Each new chapter builds on the material presented before, so the more comfortable you feel about each chapter's material, the easier the next chapter will be.

1. Show the keystrokes to add 18 and 47.

   Keystrokes Display

2. Show the keystrokes to subtract 13 from -8.

   Keystrokes Display

3. Provide the keystrokes for the following problem:

$$\frac{6.42 \times 9.83}{4.51} = ?$$

   Keystrokes Display

4. Now show the keystrokes to divide the previous result by 4.

   Keystrokes Display

5. Store the result from question #4 in storage register 3 (R3).

   Keystrokes Display

6. Store 11.72 in register 1 and 7.3 in register 2.

   Keystrokes Display

7. Multiply the value in register 3 by the value in register 1. Then divide the result by the value in register 2. Show the keystrokes.

   Keystrokes Display

Answers to Review Test for Chapter 1

1.

Keystrokes	Display	Reference
18 [ENTER]	18.00	(Page 1-4, step 9)
47 [+]	65.00	(Page 1-4, steps 10-11)

2.

Keystrokes	Display	Reference
8 [CHS] [ENTER]	-8.00	(Pages 1-3 and 1-4, steps 7, 14)
13 [-]	-21.00	

3.

Keystrokes	Display	Reference
6.42 [ENTER]	6.42	(Pages 1-5 - 1-6, steps 15-19)
9.83 [x]	63.11	
4.51 [/]	13.99	

4.

Keystrokes	Display	Reference
4 [/]	3.50	(Pages 1-5 - 1-6, steps 15-19)

5.

Keystrokes	Display	Reference
[STO] 3	3.50	(Page 1-8, steps 25-27)

6.

Keystrokes	Display	Reference
11.72 [STO] 1	11.72	(Page 1-8, steps 25-27)
7.3 [STO] 2	7.30	

7.

Keystrokes	Display	Reference
[RCL] 3	3.50	(Page 1-9, step 28)
[RCL] 1	11.72	

[x]	41.00
[RCL] 2	7.30
[/]	5.62

NOTES

Percentage and Calendar Functions

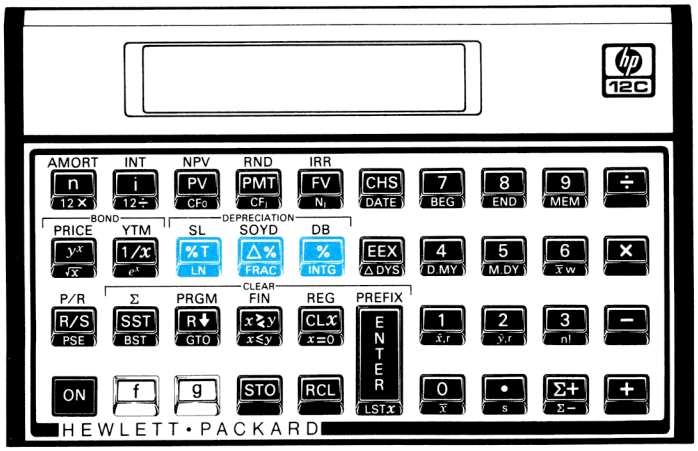
Preview

In Chapter 2 you will:

* Do three types of percentage problems.

* Perform calendar functions.

() 1. The HP-12C has three keys for solving percentage problems: [%] (percent), [Δ%] (percent difference) and [%T] (percent of total).



Locations of [%], [Δ%], and [%T]

Figure 5

Percent

() 2. Find 6% of $250.00.

Keystrokes	Display	
250	250.	The first number (the base number) is keyed in.
[ENTER]	250.00	Pressing [ENTER] separates the first number from the second.

6	6.	The percentage is keyed in.
[%]	15.00	The percentage amount is calculated.

() 3. To find the percentage of a number:

1. Key in the base number.
2. Press [ENTER].
3. Key in the percentage.
4. Press [%].

Notice that, as with the arithmetic operations, the function happens immediately when you press the [%] key.

() 4. It is easy to calculate the net amount (the base amount plus or minus the percentage amount) with your HP-12C. For example, to add the $15 just calculated to $250.00, press:

Keystrokes	Display	
[+]	265.00	Net amount.

The calculator holds the base amount inside after calculating a percentage. This means that you don't need to key in the value again --- a real convenience.

() 5. Example: You are buying a new car which lists for $10,148.00. If the dealer offers you a 9% discount, how much is the car?

Keystrokes	Display	
10148	10,148.	The base amount is keyed in.
[ENTER]	10,148.00	The base is separated from the percentage.
9	9.	The percentage is keyed in.
[%]	913.32	Amount of discount.
[-]	9,234.68	Net cost of the car.

() 6. Suppose that there is an additional sales tax of 6% on your net cost. What is the total cost of the car, including tax?

Keystrokes	Display	
6 [%]	554.08	The amount of tax (on $9,234.68) is calculated.
[+]	9,788.76	The total cost (base amount - discount + tax).

Percent Difference

() 7. Yesterday the price of your stock fell from 46 1/2 to 43 per share. What is the percentage change?

Keystrokes	Display	
46.5 [ENTER]	46.50	The base number is keyed in and separated from the second number.
43	43.	The second number is keyed in.
[Δ%]	-7.53	A 7 1/2 percent decrease.

() 8. To find the percent difference between two numbers:

1. Key in the base number. *
2. Press [ENTER] to separate the second number from the base number.
3. Key in the second number.
4. Press [Δ%].

If the second number is greater than the base number, the percent difference will be positive. If the second number is less than the base number, the percent difference will be negative. Thus a positive answer indicates an increase, while a negative answer indicates a decrease. (This guideline applies when both numbers are POSITIVE.)

() 9. Example: You purchase typewriters at $159.95 each wholesale and retail them for $195.00. What percent is your markup?

---

* If the base number keyed in is the wholesale cost, the percent difference is called the markup; if the base number keyed in is the retail cost, the percent difference is called the margin.

Keystrokes	Display	
159.95 [ENTER]	159.95	The base number is keyed in and separated from the second number.
195 [Δ%]	21.91	Percent markup.

Percent of Total

()10. To purchase that $62,000 lakefront cabin that you've had your eyes on, a $15,500 down payment is required. What percentage of the price does your down payment represent?

Keystrokes	Display	
62000 [ENTER]	62,000.00	The total purchase price is keyed in and separated.
15500 [%T]	25.00	The down payment is 25% of the purchase price.

()11. To find what percentage a number is of a total:

1. Key in the total number.
2. Press [ENTER] to separate the total number from the next number.
3. Key in the particular number you wish to convert to a percentage of the total.
4. Press [%T].

()12. Example: $5.50 is what percent of $40.00?

Keystrokes	Display	
40 [ENTER]	40.00	The total is keyed in and separated from the next number.
5.5 [%T]	13.75	The percent of total is calculated.

()13. Now here's another percentage problem where the total number must be calculated.

Example: Last year your company had sales of $34.97 million in the U.S., $21.33 million in Europe, and $15.29 million in the rest of the world. What percentage of the total sales occurred in

Europe?

Keystrokes	Display	
34.97 [ENTER]	34.97	The first number is keyed in and separated from the second.
21.33 [+]	56.30	The second number is added.
15.29 [+]	71.59	The third number is added to obtain the total sales.
21.33	21.33	21.33 is keyed in to find what percentage it is of the number in the display.
[%T]	29.79	Europe had nearly 30% of the total sales.

()14. To calculate what percentage one number is of a sum of numbers:

1. Calculate the total amount by adding the individual amounts, just as in an arithmetic calculation.

2. Key in the particular number you wish to convert to a percentage of that total.

3. Press [%T].

()15. To calculate what percent of the total sales in the preceding example occurred in the U.S. and what percent occurred in the rest of the world:

Keystrokes:	Display:	
[CLx] 34.97 [%T]	48.85	The U.S. had about 49% of the total sales.
[CLx] 15.29 [%T]	21.36	The rest of the world had a little more than 21% of the total sales.

()16. The HP-12C "remembers" in the Y-register* the total amount after a percent of total is calculated. To calculate what percentage another amount is of the total:

1. Clear the display by pressing [CLx].

2. Key in that amount.

3. Press [%T] again.

()17. Example: You are considering the purchase of an apartment with financing structured as follows:

Down payment	$25,000.00
First mortgage	$114,950.00
Second mortgage	$50,000.00

What percentage of the total financing is represented by the down payment? What percentage is represented by the first mortgage?

Keystrokes	Display	
25000 [ENTER]	25,000.00	The first number is keyed in and separated from the second number.
114950 [+]	139,950.00	The second number is added.
50000 [+]	189,950.00	The third number is added to obtain the total financing.
25000 [%T]	13.16	The down payment percentage is calculated.
[CLx] 114950 [%T]	60.52	The first mortgage percentage is calculated.

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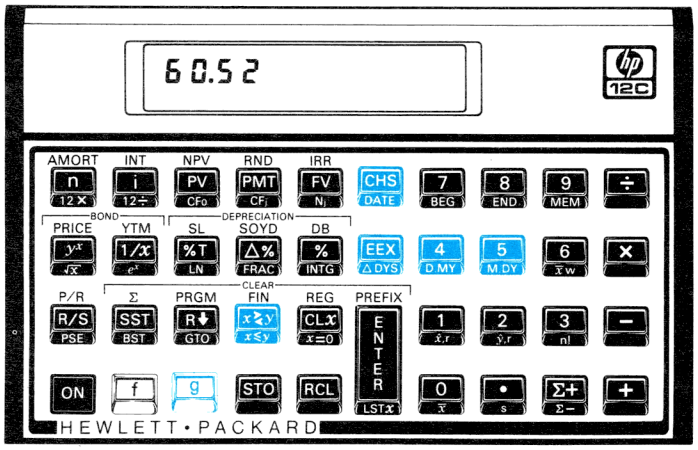
* The number in the Y-register is the number that was keyed in first in a two-number operation. For example, 3 [ENTER] 4 would place 3 in the Y-register and 4 in the X-register (the display). For more information on the stack registers see Appendix A in the HP-12C Owner's Handbook and Problem-Solving Guide.

Calendar Functions

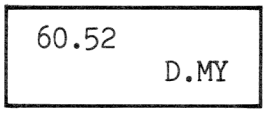
()18. The HP-12C has two keys which perform calendar functions: [g] [Δ DYS] (number of days between dates) and [g] [DATE] (a date that is in the future or past), and two keys to set the calendar format: [g] [M.DY] (month, day, year) and [g] [D.MY] (day, month, year)



Locations of [x<>y], [g][Δ DYS], [g][DATE], [g][M.DY], and [g][D.MY]

Figure 6

()19. Set the HP-12C to day, month, year format by pressing [g], releasing, then pressing [4]. This activates the blue D.MY function on the 4 key. D.MY will appear in the display.



()20. Now set the HP-12C to month, day, year format by pressing [g], releasing, then pressing [5]. D.MY will disappear from the display. Notice that M.DY does not appear. If you see D.MY in the display, the HP-12C is in day, month, year mode. If you do not see D.MY in the display, the HP-12C is in month, day, year mode.

()21. From here on, whenever a prefix key is used in a keystroke sequence, it will be shown like this: [g][M.DY] or [g][D.MY] or [f] CLEAR [REG]. Remember that the prefix key ([f] or [g]) is always pressed, then released, before the next key is pressed.

Number of Days Between Dates

()22. How many days were there between September 5, 1981 and December 25, 1981?

Keystrokes	Display	
[g] [M.DY]	60.52	The "month, day, year" calendar format is set.
9.051981	9.051981	The first date is keyed in.
[ENTER]	9.05	The date is entered into the calculator. *
12.251981	12.251981	The second date is keyed in.
[g] [ΔDYS]	running	This word flashes to let you know that your HP-12C is calculating.
	111.00	In a few moments, the display shows the actual number of days.
[x<>y]	110.00	The display shows the number of days counted on the basis of a 30-day month (360 days per year).

Date Format

()23. To key in a specific date in month, day, year (MM.DDYYYY) format:

1. Set the calendar format to month, day, year ([g] [M.DY]).
2. Key in the one or two digits of the month.
3. Press the decimal point key ([.]).
4. Key in the two digits of the day. (If the day is one digit, be sure to key in a zero first; i.e., for February 4, 1981, key in 2.041981)
5. Key in the four digits of the year.

---

* Although the entire number is "stored" in the calculator, it is being displayed in the standard display format with two decimal places shown. To display a different number of decimal places, press [f] followed by a digit key (0 through 9) specifying the number of decimal places desired.

To key in a date in day, month, year (DD.MMYYYY) format:

1. Set the calendar format to day, month, year ([g] [D.MY]).

2. Key in the one or two digits of the day.

3. Press the decimal point key ([.]).

4. Key in the two digits of the month. (If the month is one digit, be sure to key in a zero first; i.e., for 14 March 1980, key in 14.031980).

5. Key in the four digits of the year.

()24. Determine the number of days between 13 November 1981 and 5 April 1982, using the "day, month, year" calendar format.

Keystrokes	Display	
[g][D.MY]	110.00	The "day, month, year" calendar format is set.
13.111981	13.111981	The first date is keyed in.
[ENTER]	13.11	The date is entered into the calculator.
5.041982	5.041982	The second date is keyed in.
[g][Δ DYS]	143.00	The actual number of days is calculated.

()25. To calculate the number of days between two given dates:

1. Set the calendar format to either [M.DY] or [D.MY].

2. Key in the earlier date (in the chosen calendar format) and press [ENTER].

3. Key in the later date (in the chosen calendar format) and press [g][Δ DYS]. The displayed result is the actual number of days.

4. Press [x<>y] to see the number of days on a 30-day month basis (360 days per year).

()26. How many days (on an actual day basis) were there between October 14, 1981 and March 21, 1982 (month, day, year format)?

Keystrokes	Display	
[g][M.DY]		The "month, day, year" calendar format is set.
10.141981	10.141981	The first date is keyed in.
[ENTER]	10.14	The date is entered into the calculator.
3.211982	3.211982	The second date is keyed in.
[g] [ΔDYS]	158.00	Actual number of days.

Future or Past Dates

()27. If you purchase a 120-day option on a piece of land on July 3, 1981, what is the expiration date?

Keystrokes	Display	
[g][M.DY]		The "month, day year" calendar format is set.
7.031981 [ENTER]	7.03	The first date is keyed in and separated from the next entry.
120	120.	The number of days in the future is keyed in.
[g] [DATE]	10,31,1981 6	The expiration date is October 31, 1981. The 6 on the right indicates the 6th day of the week - October 31, 1981 is on a Saturday. (1 for Monday through 7 for Sunday.)

()28. To determine the date and day that is a specified number of days from a given date:

1. Set the calendar format to either [M.DY] or [D.MY].
2. Key in the given date (in the chosen calendar format) and press [ENTER].
3. Key in the number of days.

4. If the other date is in the past, press [CHS].

5. Press [g] [DATE].

The digit at the right of the displayed answer indicates the day of the week: 1 for Monday through 7 for Sunday.

()29. Example: A 182-day money market certificate matures on March 22, 1982. On what date was it purchased?

Keystrokes	Display	
[g][M.DY]		The "month, day, year" calendar format is set.
3.221982 [ENTER]	3.22	The first date is keyed in and separated from the next entry.
182 [CHS]	-182.	The number of days in the past is keyed in.
[g][DATE]	9,21,1981 1	The purchase date was September 21, 1981, a Monday.

Chapter 2 Summary

* [%] is used to find the percentage of a number.
  Reference: Pages 2-18 - 2-19, steps 2-6.

* [Δ%] finds the percent difference between two numbers.
  Reference: Page 2-20, steps 7-9.

* [%T] finds what percentage a number is of a total.
  Reference: Pages 2-21 - 2-23, steps 10-17.

* [g] [D.MY] sets the calendar format to day, month, year.
  Reference: Page 2-24, step 19.

* [g] [M.DY] sets the calendar format to month, day, year.
  Reference: Page 2-24, step 20.

* [g] [ΔDYS] calculates the number of days between two dates.
  Reference: Pages 2-25 - 2-26, steps 22-26.

* [g] [DATE] determines the date that is a specified number of days from a given date.
  Reference: Pages 2-27 - 2-28, steps 27-29.

Review Test for Chapter 2

The answers are on Page 2-32, immediately following this review test.

1. What is 6.5% of $120.00?

   Keystrokes Display

2. A piece of furniture costs $344 with an additional 3% sales tax. What is the total cost (price plus sales tax)?

   Keystrokes Display

3. If your rent jumps from $280 to $325 per month, what percent is the increase?

   Keystrokes Display

4. You own Coakley Laboratories stock worth $470, Idylwild Aircraft stock worth $1620, and Burley Industries stock worth $2250. What percent of the total value of your portfolio does each stock represent?

Keystrokes	Display

5. How many days are there between November 13, 1981 and April 7, 1983?

Keystrokes	Display

6. A 90-day option was purchased on October 9, 1981. What is the expiration date?

Keystrokes	Display

Answers to Review Test for Chapter 2

1.	Keystrokes	Display	Reference
	120 [ENTER]	120.00	(Page 2-19, step 3)
	6.5 [%]	7.80	

2.	Keystrokes	Display	Reference
	344 [ENTER]	344.00	(Page 2-19, step 4)
	3 [%]	10.32	
	[+]	354.32	

3.	Keystrokes	Display	Reference
	280 [ENTER]	280.00	(Page 2-20, step 8)
	325 [Δ %]	16.07	

4.	Keystrokes	Display	Reference
	470 [ENTER]	470.00	(Page 2-21, step 11)
	1620 [+]	2090.00	
	2250 [+]	4,340.00	
	470 [%T]	10.83	% Coakley Laboratories
	[CLx]	0.00	
	1620 [%T]	37.33	% Idylwild Aircraft
	[CLx]	0.00	
	2250 [%T]	51.84	% Burley Industries

5. Keystrokes	Display	Reference
11.131981 [ENTER]	11.13	(Page 2-26, step 25)
4.071983 [g][Δ DYS]	510.00	

6. Keystrokes	Display	Reference
10.091981 [ENTER]	10.09	(Page 2-27, step 28)
90 [g][DATE]	1,07,1982 4	The expiration date is January 7, 1982, a Thursday.

The Time Value of Money

Preview

In Chapter 3 you will:

* Do simple interest calculations.
* Learn about the cash flow diagram and the cash flow sign convention.
* Calculate the number of payment periods ([n]).
* Calculate the periodic interest rate ([i]).
* Calculate the present value ([PV]).
* Calculate the periodic payment amount ([PMT]).
* Calculate the future value ([FV]).

() 1. Many financial problems are based on the concept of charging a fee (interest charge) for the use of someone else's money for a fixed period of time. Interest may be handled in one of two ways:

1. Simple interest

or

2. Compound interest

Simple Interest

() 2. Example: If you borrow $500 for two years at fifteen percent annual simple interest, how much interest would you pay?

The amount of interest can be found by multiplying the principal (500) times the interest rate (.15) times the time (2).

Keystrokes	Display	
500 [ENTER]	500.00	The principal is keyed in and separated from the next number.
.15 [x]	75.00	The amount of interest for one year is calculated.

2 [x]	150.00	The total amount of interest is calculated.

() 3. If you borrow the money for only 4 months, how much interest would you pay?

Since the time (4 months) is less than 1 year, only a portion of the yearly interest would be due. The amount of interest would be:

Keystrokes	Display	
500 [ENTER] .15 [x]	75.00	The yearly interest is calculated.
12 [/]	6.25	The monthly interest is calculated.
4 [x]	25.00	The total interest due is calculated.

() 4. With simple interest, only the principal (the original amount of money) earns interest for the entire life of the transaction. The interest earned, plus the principal, is repaid in one lump sum.

Compound Interest

() 5. When the simple interest is added to the principal at stated intervals, and thereafter also earns interest, the interest is said to be compounded. This method of re-investing earned interest is very common in business transactions and is called compound interest.

() 6. There are five quantities or variables which have become standards for describing most compound interest problems.

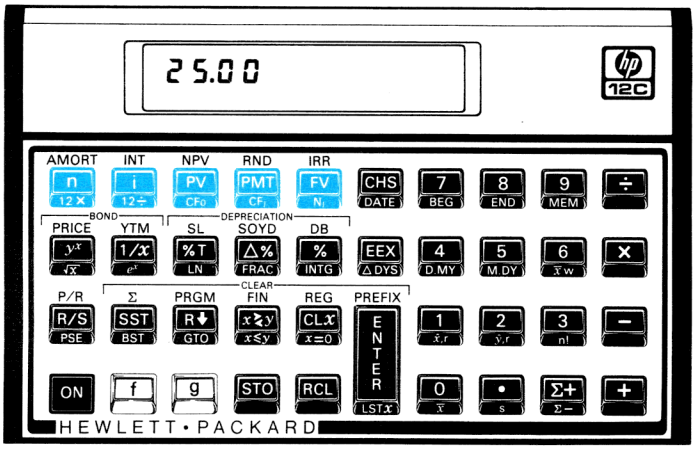
[n] number of payment periods

[i] interest rate each period (periodic interest rate)

[PV] present value

[PMT] payment amount each period (periodic payment amount)

[FV] future value



Location of Financial Keys

Figure 7

() 7. These five variables have special storage registers in the HP-12C just for them - the financial registers. These financial registers may be cleared at any time by pressing [f] CLEAR [FIN].

() 8. Press [f], release, then press [x<>y] to clear the financial registers. This does not clear the display, so you should still see the result from the previous example:

25.00

() 9. The five financial variables can best be explained by referring to a pictorial representation called the cash flow diagram.

The diagram begins with a horizontal line called the time line. It represents the term of a financial problem and is divided into a number (n) of compounding periods of equal length.

Figure 8

()10. A financial problem that covers a 6 month period would be diagrammed as follows:

Figure 9

()11. The exchange of money is represented with vertical arrows. Money received is represented by an arrow pointing up (positive) from the point on the time line where the transaction occurred; money paid out is represented by an arrow pointing down (negative).

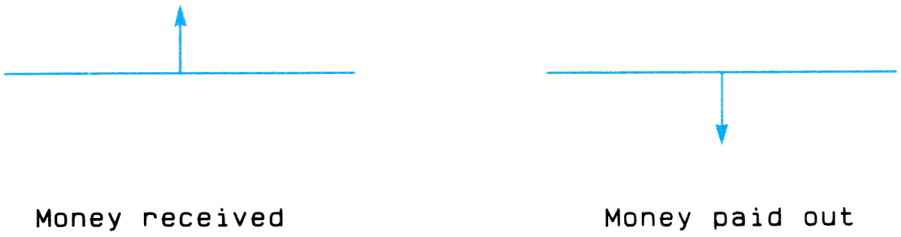


Figure 10

()12. A single cash flow at the start of the time line is called the present value (PV). A similar single cash flow at the end of the time line is called the future value (FV).

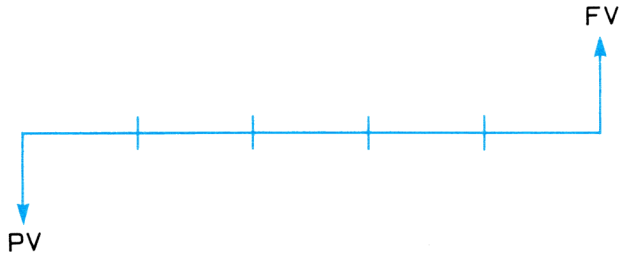


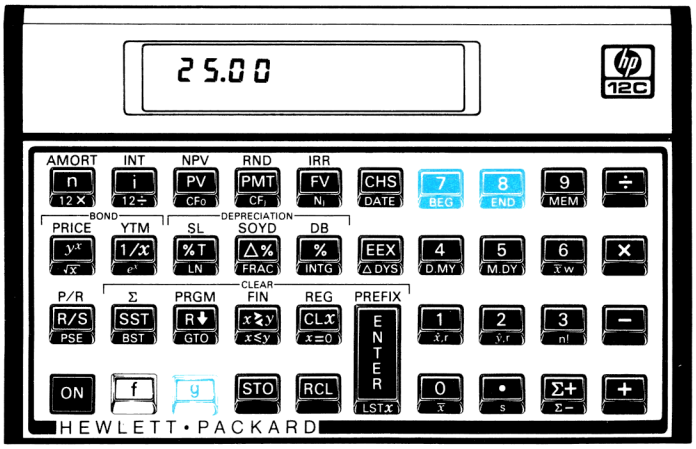
Figure 11

()13. Payment (PMT) represents a series of cash exchanges of the same sign (direction) and amount. In the standard cash flow diagram, there is one payment per compounding period. The number of payments is the same as the number of compounding periods. The payments can occur either at the beginning of the period (BEG) or at the end of the period (END).

Figure 12

()14. When working compound interest problems involving payments (PMT), it

is always necessary to specify whether the payment is at the BEGinning of the period or at the END of the period. This will be noted in the examples as (BEG) or (END).



Location of [g][BEG] and [g][END]

Figure 13

()15. The HP-12C can be set to solve either kind of compound interest problem. The keys used for this are shown in Figure 13.

()16. Set the HP-12C in the BEGin mode by pressing [g][BEG]. BEGIN will then appear in the bottom of the display:

```
25.00
   BEGIN
```

()17. Now set the HP-12C in the END mode by pressing [g][END]. BEGIN will disappear from the display. Notice that END does not appear. If you see BEGIN in the display, the HP-12C is in the BEGin mode. If you do not see BEGIN in the display, the HP-12C is in the END mode.

()18. The fifth variable (i) is the compound interest rate per period. In the HP-12C, this interest rate is always entered and displayed as a percent.

()19. The following examples demonstrate the five variables n, i, PV, PMT, and FV and how to use the cash flow diagram to represent compound interest problems.

()20. Example: A payment amount of $584.53 is necessary to fully amortize (pay-off) a mortgage (loan) of $50,000 over 30 years. Payments are made monthly; interest is compounded monthly at 1.15% (13.80% annually)

and the first payment is made 1 month after the exchange of the initial loan amount (payments occur at the END of each period). Draw the cash flow diagram to depict the transaction from the viewpoint of the borrower.

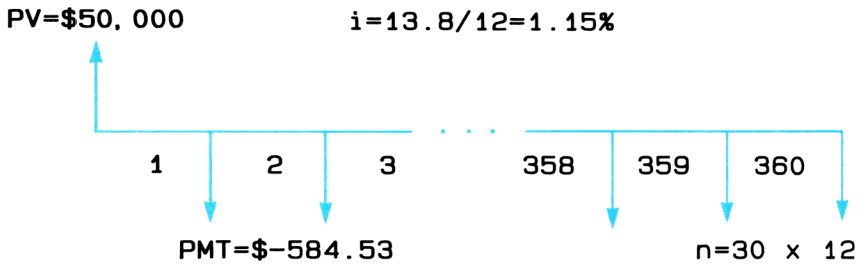


Figure 14

NOTE: PV is positive (arrow pointing up) because it represents cash received. PMT is negative (arrow pointing down) because it represents cash paid out. The use of positive and negative signs to represent the direction in which cash is exchanged is called the CASH FLOW SIGN CONVENTION.

From the lender's point of view of the above problem, the cash flow diagram would look like this:

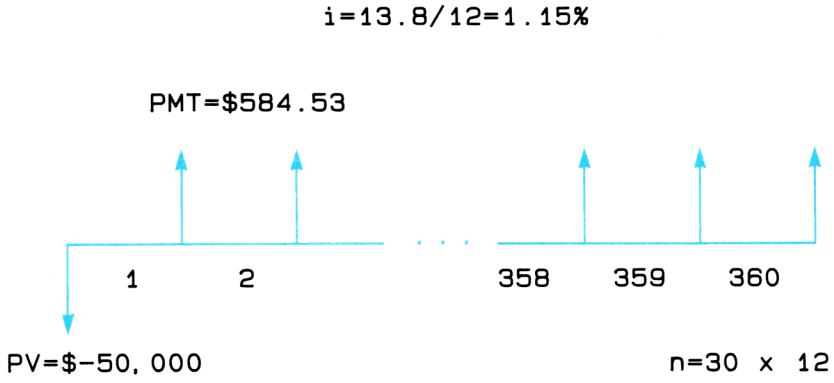


Figure 15

()21. Example: Draw a cash flow diagram to represent the following transaction.

What will be the balance in a savings account (FV) at the end of 4 years if an initial deposit of $1,000 is made followed by 4 annual deposits of $300 (made at the END of each period)? Interest is compounded yearly at 5%.

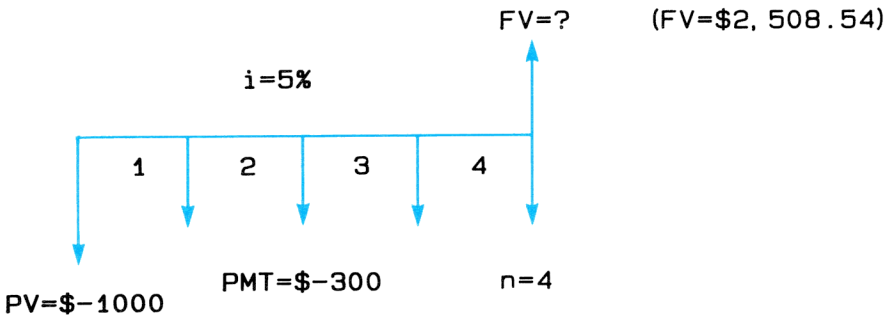


Figure 16

()22. When using the cash flow diagram and the cash flow sign convention to format compound interest problems, the following rules always apply:

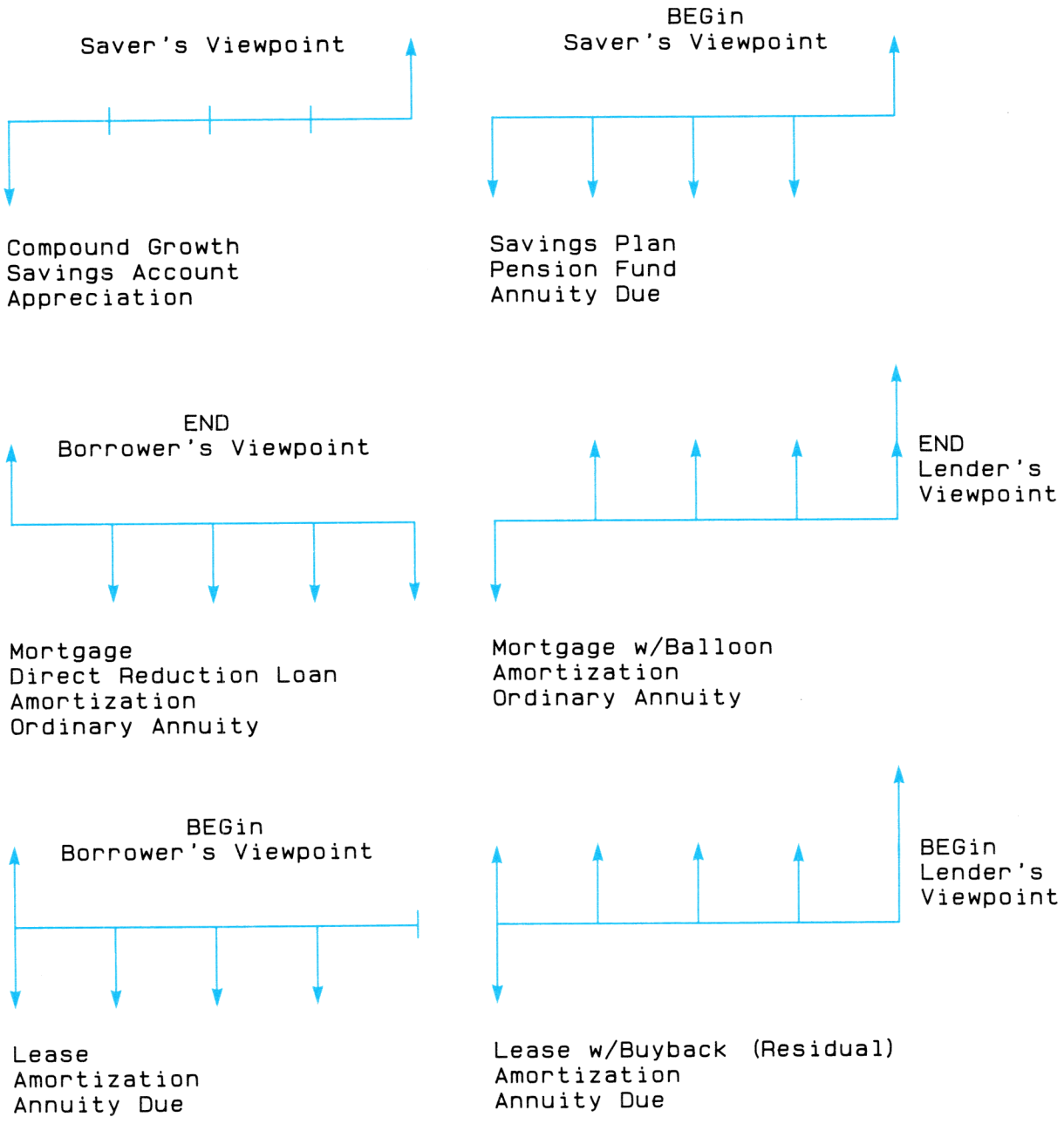
* n and i must correspond to the same period of time.

* Both n and i must be present in a problem. Either both values are known, or one is known and the other is to be computed.

* A valid financial transaction must always include at least one positive cash flow (cash received) and one negative cash flow (cash paid out).

()23. The cash flow diagram can be used to describe many variations of compound interest problems. Although the terminology used to describe a particular cash transaction may vary from industry to industry, the cash flow diagram is the same. In providing a means of describing financial problems without using terminology specific to a particular industry, the cash flow diagram becomes, in a sense, a universal language.

()24. Six variations of the basic diagram are presented on the next page. Under each diagram is listed a number of the more common terms used to describe the represented cash exchange. Note that diagrams involving payments may be represented with payments at the BEGinning of the period or at the END of the period. And, the diagrams can represent either the lender's or the borrower's point of view.



Six Variations of the Cash Flow Diagram

Figure 17

()25. Solving a financial problem on the HP-12C is basically a matter of keying in the quantities identified in the cash flow diagram using the corresponding keys, and then calculating the unknown quantity by pressing the corresponding key. Several examples which demonstrate this technique follow. Remember from step 6 the definitions of the five financial variables:

[n] number of payment periods

[i] interest rate each period (periodic interest rate)

[PV] present value

[PMT] payment amount each period (periodic payment amount)

[FV] future value

()26. Example: What monthly payment amount is necessary to repay a 30 year, $60,000 mortgage with an annual interest rate of 15%?

The cash flow diagram looks like this:

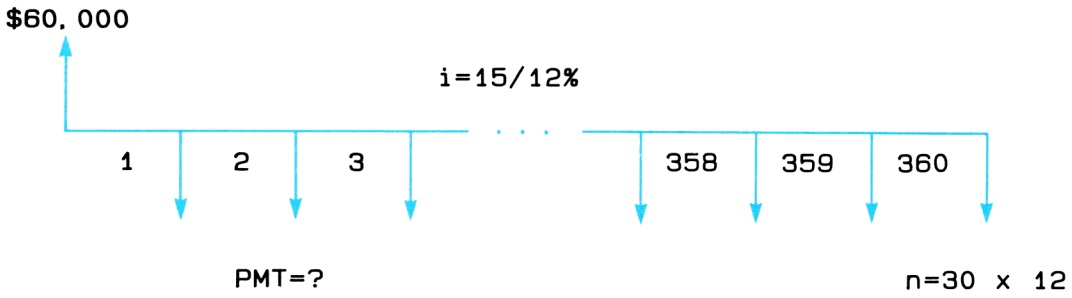


Figure 18

The keystroke solution is:

Keystrokes	Display	
[f] CLEAR [FIN]	25.00	The financial registers are cleared. The display remains unchanged.
[g] [END]	25.00	The payment mode is set to END. ("BEGIN" does not appear in the display, so you know that you're in END mode.)
30 [ENTER] 12 [x]	360.00	The total number of payments is calculated.

[n]	360.00	The total number of payments is stored.
15 [ENTER] 12 [/]	1.25	The monthly interest rate is calculated.
[i]	1.25	The monthly interest rate is stored.
60000 [PV]	60,000.00	The mortgage amount is stored.
[PMT]	-758.67	The monthly payment is calculated.* The value is negative because this amount is paid out each month.

()27. Example: In the previous example, if the borrower could only afford to pay $740 each month, how much could he borrow?

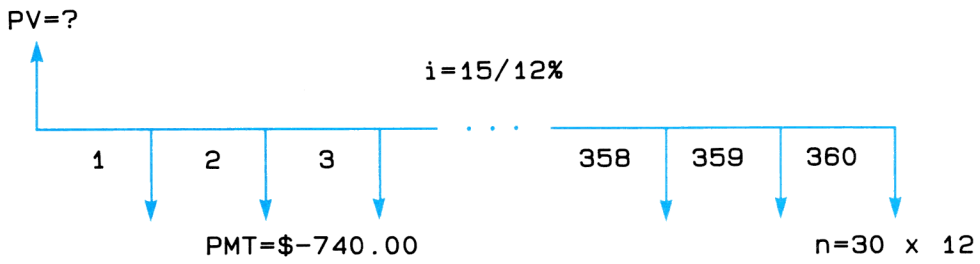


Figure 19

Keystrokes	Display	
740 [CHS] [PMT]	-740.00	The new monthly payment is stored. The other values do not need to be re-entered.
[PV]	58,523.75	The maximum loan amount is calculated.

---

* When the payment (or any other financial variable) is calculated, it is also stored in the corresponding financial register.

()28. A house purchased 3 years ago for $48,000 is sold for $65,500. What yearly compounded appreciation rate does this represent?

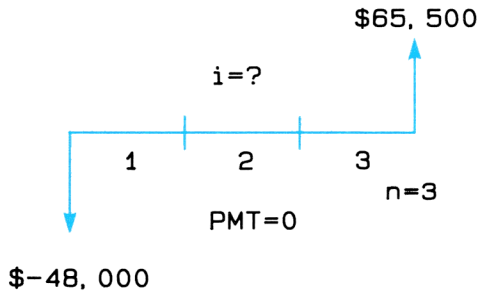


Figure 20

Keystrokes	Display	
[f] CLEAR [FIN]	58,523.75	Clears the financial registers (but not the display). Since there is no periodic payment amount, it is not necessary to specify BEGin or END mode.
3 [n]	3.00	The total number of periods is stored.
48000 [CHS] [PV]	-48,000.00	The present value is stored.
65500 [FV]	65,500.00	The future value is stored.
[i]	10.92	The percentage of yearly appreciation is calculated.

()29. If the house in the previous example were to appreciate 12% each year, how much would it be worth today?

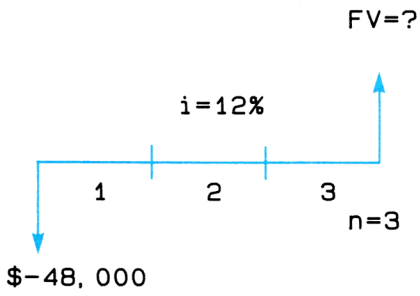


Figure 21

Keystrokes	Display	
12 [i]	12.00	The yearly appreciation rate is stored.
[FV]	67,436.54	The current value is calculated assuming 12% annual appreciation.

()30. A development company wishes to purchase a group of condominiums which return an annual cash flow of $21,400. The expected holding period is 5 years, and the estimated net return from the sale is $620,000. Calculate the maximum amount the company can pay for the condominiums in order to realize at least a 16% yield.

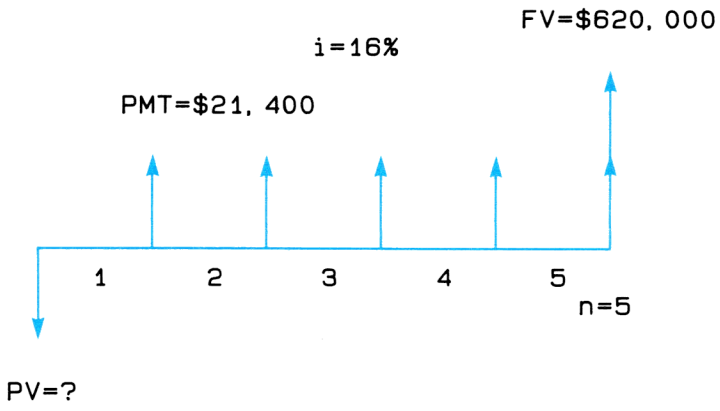


Figure 22

Keystrokes	Display	
[f] CLEAR [FIN]	67,436.54	The financial registers are cleared.
[g] [END]	67,436.54	The payment mode is set to END.*
5 [n]	5.00	The holding period is stored.
16 [i]	16.00	The desired yield is stored.
21400 [PMT]	21,400.00	The annual cash flow is stored.
620000 [FV]	620,000.00	The estimated selling price is stored.
[PV]	-365,259.95	The maximum purchase price to yield 16% is calculated.

()31. If the condominiums are purchased for $355,000, what is the annual yield?

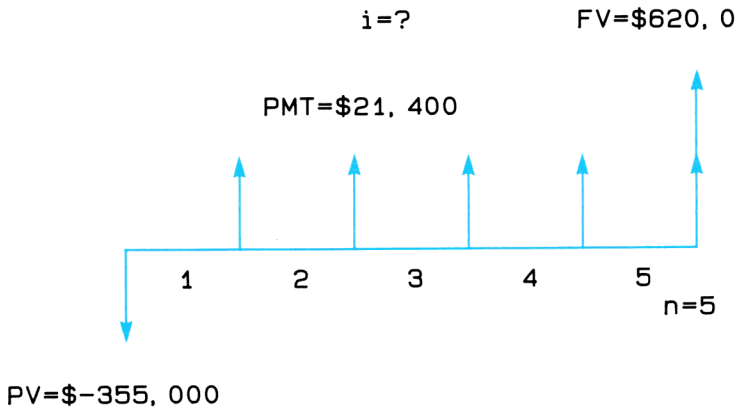


Figure 23

---

* Since the display does not show "BEGIN", it is not necessary to press [g][END]. However, to help you develop the habit of thinking about the payment mode each time you solve a financial problem, the payment mode keystroke will always be shown even though it may not be needed. One of the most common errors that people make when attempting to solve financial problems is using the wrong payment mode.

Keystrokes	Display	
355000 [PV]	355,000.00	The purchase price is stored.
[i]	Error 5	What happened?

Looking back at these keystrokes, you will discover that the purchase price (money paid out) was not entered as a negative number. This is a very common error which everyone discovers at some time, and it can easily be corrected.* First you should clear the error message from the display, and then re-enter the correct purchase price.

Keystrokes	Display	
[CLx]	355,000.00	The error is cleared and the calculator is restored to its condition before the improper operation was attempted.
[CHS] [PV]	-355,000.00	The purchase price is corrected and stored.
[i]	16.73	The percent annual yield is calculated.

Cash flows must be entered using the cash flow sign convention --- money received is positive and money paid out is negative.

()32. Assuming a $355,000 purchase price, what sales price is necessary to achieve a 17.25% annual yield?

---

* For a complete list of error messages, refer to Appendix C of the HP-12C Owner's Handbook and Problem-Solving Guide.

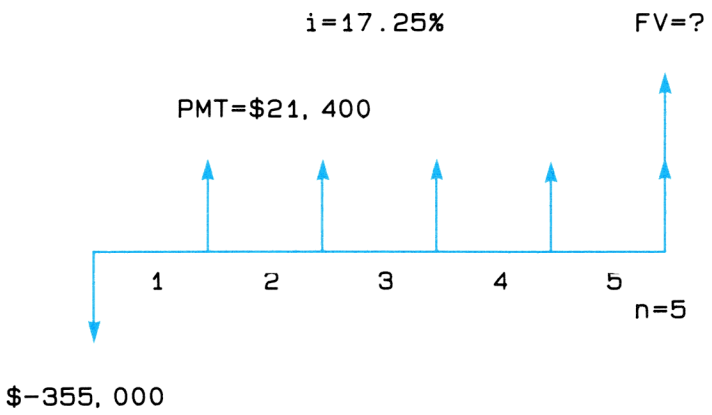


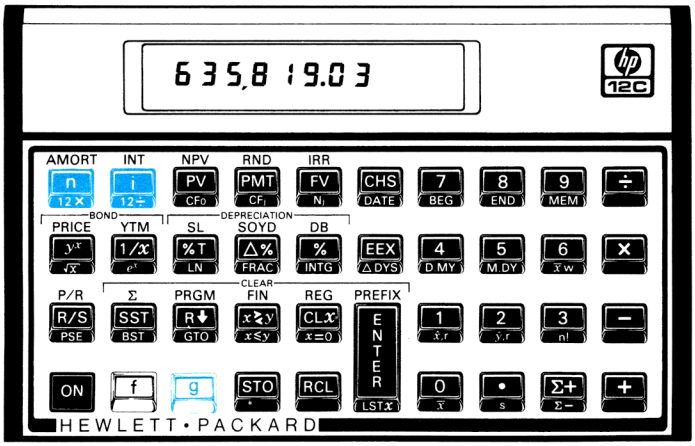
Figure 24

Keystrokes	Display	
17.25 [i]	17.25	The desired yield is stored.
[FV]	635,819.03	The sales price is calculated

()33. If interest is compounded monthly, you can use a shortcut provided on the calculator to calculate and store n and i:

1. To calculate and store the number of months (n), key the number of years into the display and press [g] [12x].

2. To calculate and store the monthly interest (i), key the annual interest rate into the display and press [g] [12/].



Location of [g][12x] and [g][12/]

Figure 25

These keys not only multiply or divide the displayed number by 12, but they also automatically store the result in the corresponding register.

()34. Example: Calculate the monthly payment amount needed to repay a $51,000, 29 year mortgage with an annual interest rate of 14.25%.

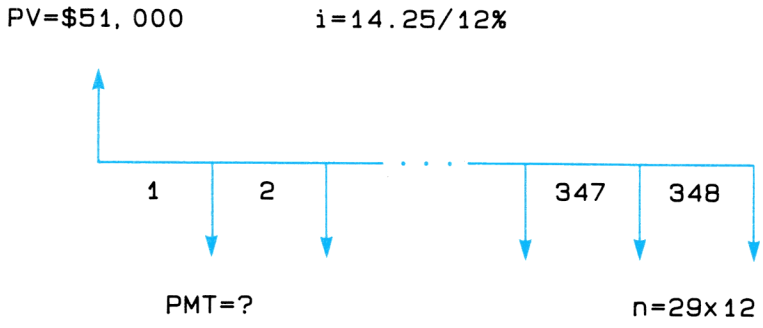


Figure 26

Keystrokes	Display	
[f] CLEAR [FIN]	635,819.03	The financial registers are cleared.
[g] [END]	635,819.03	The payment mode is set to END.
29 [g] [12x]	348.00	The total number of monthly payments is calculated and stored.
14.25 [g] [12/]	1.19	The monthly interest rate is calculated and stored.
51000 [PV]	51,000.00	The mortgage amount is stored.
[PMT]	-615.75	The monthly payment (to be paid) is calculated.

()35. Suppose that the annual interest rate is increased to 14.6%. What is the new payment amount?

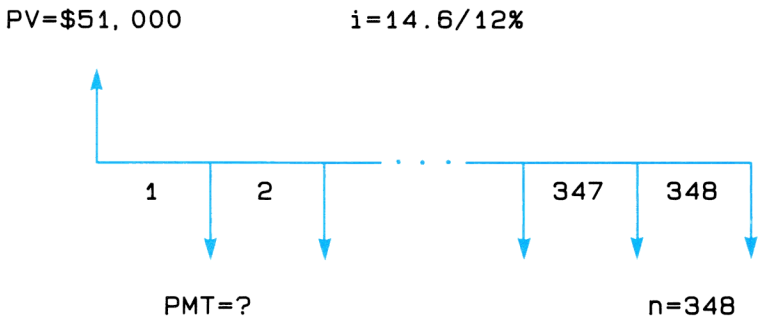


Figure 27

Keystrokes	Display	
14.6 [g] [12/]	1.22	The new monthly interest rate is calculated and stored.
[PMT]	-629.87	The new monthly payment is calculated.

()36. What is the balance on the previous mortgage at the end of 5 years? (What is the amount to be paid, IN ADDITION TO THE MONTHLY PAYMENT, to pay off the mortgage at the end of year 5?)

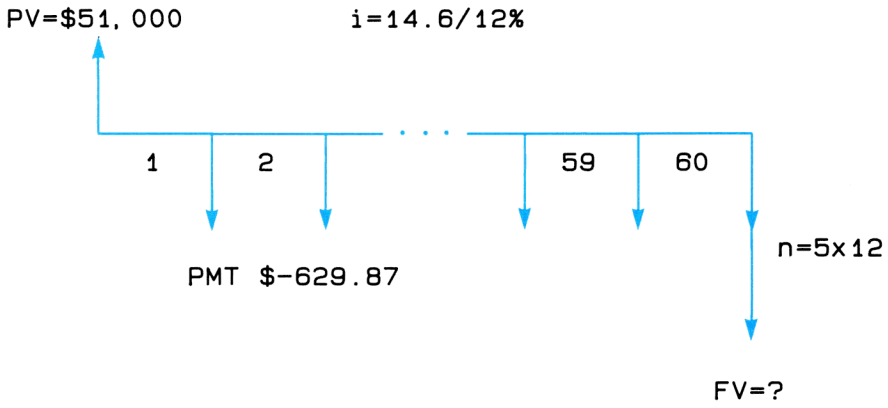


Figure 28

Keystrokes	Display	
5 [g] [12x]	60.00	The period where the balance occurs is calculated and stored.
[FV]	-50,179.44	The balance is calculated.

()37. How much money must you set aside in a savings account each quarter in order to accumulate $4000 in five years? The account compounds quarterly with an annual interest rate of 6% and deposits "BEGin" immediately.

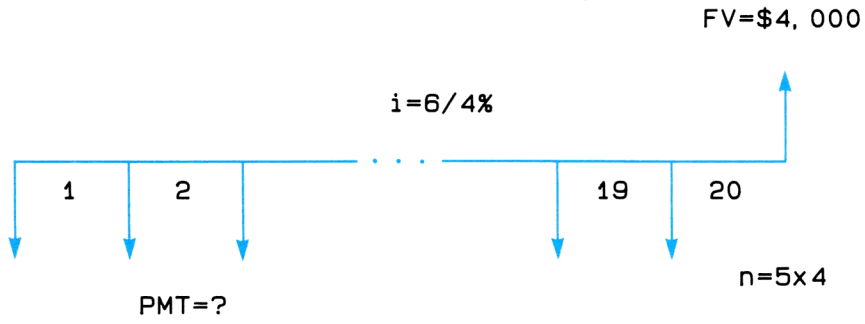


Figure 29

Keystrokes	Display	
[f] CLEAR [FIN]		The financial registers are cleared.
[g] [BEG]		The payment mode is set to BEGin. (See BEGIN in the display.)
5 [ENTER] 4 [x] [n]	20.00	The total number of quarters is stored.
6 [ENTER] 4 [/] [i]	1.50	The quarterly interest rate is stored.
4000 [FV]	4,000.00	The total to be accumulated is stored.
[PMT]	-170.43	The amount to deposit each quarter is determined.

()38. In the previous example, what interest rate did the bank pay if the actual amount at the end of the five years was $4,025.50?

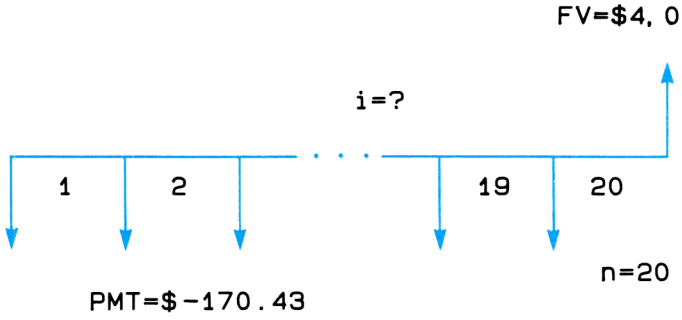


Figure 30

Keystrokes	Display	
4025.50 [FV]	4,025.50	The total accumulation is stored.
[i]	1.56	The quarterly interest rate is calculated.
4 [x]	6.23	The annual interest rate is calculated.

()39. If you increase the deposits to $200 each quarter, how long will it take to accumulate $4200? To do this example as shown, steps 37 and 38 must be calculated immediately preceding step 39.

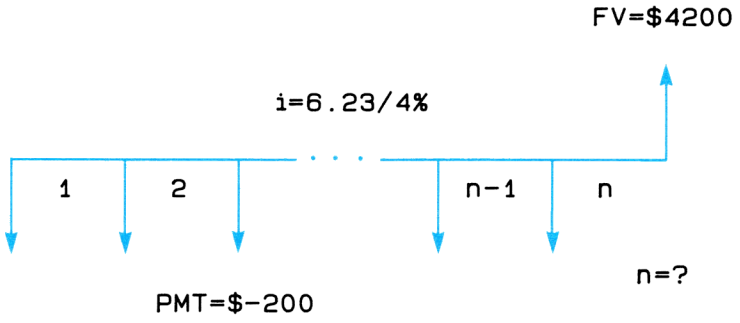
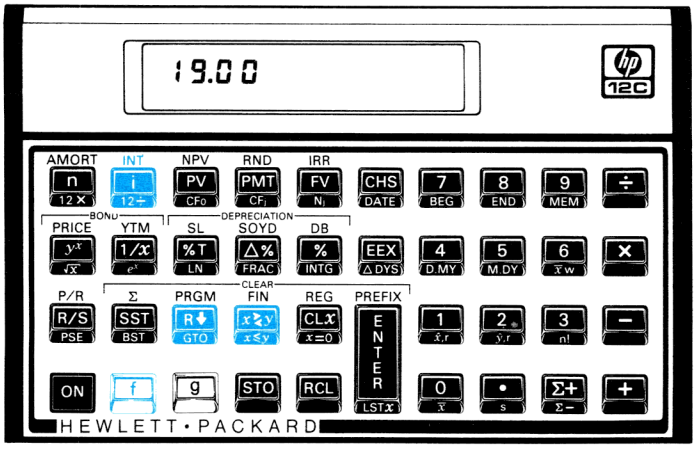


Figure 31

Keystrokes	Display	
200 [CHS] [PMT]	-200.00	The new payment amount is stored.
4200 [FV]	4,200.00	The new total accumulation is stored.
[n]	19.00	The number of quarters is calculated. The HP-12C has rounded the answer to the next higher integer.

Simple Interest

()40. The financial keys ([n], [i], [PV], [PMT], [FV]) are also used for entering information in a simple interest problem. The HP-12C simultaneously calculates simple interest on both a 360-day basis and a 365-day basis with the [f][INT] key.



Location of [f][INT], [R↓], and [x<>y]

Figure 32

()41. Example: Your friend needs a loan and has requested that you lend him $650 for 60 days. If you lend him the money at 14% simple interest, to be calculated on a 360-day basis, how much will he owe you?

Keystrokes	Display	
[f] CLEAR [FIN]	19.00	The financial registers are cleared.
60 [n]	60.00	The number of days is stored.
14 [i]	14.00	The annual interest is stored.
650 [CHS] [PV]	-650.00	The principal is stored.
[f] [INT]	15.17	The interest on a 360-day basis is calculated.
[+]	665.17	The total amount owed is calculated.

()42. The following keystrokes can be used to find the amount of simple interest. In this case, it makes no difference whether the HP-12C is in BEGin or END mode.

1. Press [f] CLEAR [FIN].

2. Key in, or calculate, the number of days and press [n].

3. Key in the annual interest rate (as a percent) and press [i].

4. Key in the principal amount and press [CHS] [PV].

5. Press [f] [INT] to calculate and display the amount of interest on a 360-day basis.

   (Optional: To display the interest on a 365-day basis, press [R↓][x<>y].

6. Press [+] to add the interest in the display to the principal.

()43. Example: How much interest is due on a 90-day note for $850 at 15% simple interest, figured on a 365-day basis? What is the total amount owed?

Keystrokes	Display	
[f] CLEAR [FIN]	665.17	The financial registers are cleared.
90 [n]	90.00	The number of days is stored.
15 [i]	15.00	The annual interest is stored.
850 [CHS] [PV]	-850.00	The principal is stored.
[f][INT][R↓][x<>y]	31.44	The interest on a 365-day basis is calculated.
[+]	881.44	The total amount owed is calculated.

Chapter 3 Summary

* [n] is the total number of payment periods. Reference: Page 3-35, step 6.

* [i] is the interest rate each period. Reference: Page 3-35, step 6.

* [PV] is the present value. Reference: Page 3-35, step 6.

* [PMT] is the periodic payment amount. Reference: Page 3-35, step 6.

* [FV] is the future value. Reference: Page 3-35, step 6.

* [f] CLEAR [FIN] clears the financial registers. Reference: Page 3-36, step 7.

* The cash flow diagram is the pictorial representation of a financial problem. Reference: Pages 3-36 - 3-37, steps 9-13.

* [g] [END] means that payments are made at the end of the payment period. Reference: Page 3-37, step 13.

* [g] [BEG] means that payments are made at the beginning of the payment period. Reference: Page 3-37, step 13.

* [n] and [i] must correspond to the same period of time. Reference: Page 3-40, step 22.

* Both [n] and [i] must be present in a problem. Reference: Page 3-40, step 22.

* A valid financial transaction must have at least one positive cash flow and one negative cash flow. Reference: Page 3-40, step 22.

* [g] [12x] multiplies the number in the display by 12 and stores the result in [n]. Reference: Page 3-48, step 33.

* [g] [12/] divides the number in the display by 12 and stores the result in [i]. Reference: Page 3-48, step 33.

* [f] [INT] calculates the amount of simple interest. Reference: Pages 3-52 - 3-54, steps 40-43.

Review Test for Chapter 3

The answers are on Page 3-58, immediately following this review test.

1. What monthly payment amount is necessary to amortize a 30-year, $50,000 mortgage with an annual interest rate of 13.5%?

   Keystrokes Display

2. What would be the monthly payment in question #1 if the interest rate is increased to 14%?

   Keystrokes Display

3. What is the remaining balance on the mortgage in question #2 at the end of year 5?

   Keystrokes Display

4. If you deposit $100 in a 6% savings account, how long will it take you to double your funds? Assume that interest is paid quarterly.

   Keystrokes Display

5. What quarterly interest rate is necessary for you to double your funds in 8 years?

Keystrokes	Display

6. If you deposit $100 at the beginning of each month into an account which pays 6 1/2% annual interest compounded monthly, how much will you have in the account in 1 year?

Keystrokes	Display

7. How much simple interest will you receive on a 90-day, $10,000 note at 11%? Assume a 360-day year.

Keystrokes	Display

Answers to Review Test for Chapter 3

1. Keystrokes	Display	Reference
[f] CLEAR [FIN]		(Page 3-49, step 34)
[g] [END]		
30 [g] [12x]	360.00	
13.5 [g] [12/]	1.13	
50000 [PV]	50,000.00	
[PMT]	-572.71	

2. Keystrokes	Display	Reference
14 [g] [12/]	1.17	(Page 3-49, step 35)
[PMT]	-592.44	

3. Keystrokes	Display	Reference
5 [g] [12x]	60.00	(Page 3-50, step 36)
[FV]	-49,215.41	

4. Keystrokes	Display	Reference
[f] CLEAR [FIN]		(Pages 3-50 - 3-52, steps 37-39)
6 [ENTER] 4 [/] [i]	1.50	
100 [CHS] [PV]	-100.00	
200 [FV]	200.00	
[n]	47.00	Number of quarters.

5.

Keystrokes	Display	Reference
8 [ENTER] 4 [x] [n]	32.00	(Page 3-44, step 28)
[i]	2.19	Quarterly interest rate.

6.

Keystrokes	Display	Reference
[f] CLEAR [FIN]		(Pages 3-50 - 3-52, steps 37-39)
[g] [BEG]		
1 [g] [12x]	12.00	
6.5 [g] [12/]	0.54	
100 [CHS] [PMT]	-100.00	
[FV]	1,243.10	

7.

Keystrokes	Display	Reference
[f] CLEAR [FIN]		(Page 3-53, step 42)
90 [n]	90.00	
11 [i]	11.00	
10000 [CHS] [PV]	-10,000.00	
[f] [INT]	275.00	

Additional Financial Functions

Preview

In Chapter 4 you will:

* Do an amortization schedule.

* Learn about discounted cash flow analysis: IRR and NPV.

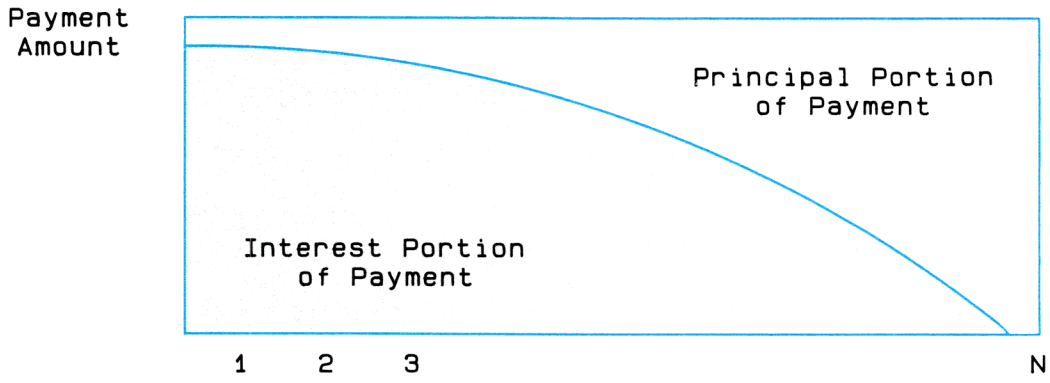
Amortization Schedules

() 1. Most mortgages and installment loans are in a class commonly called "direct reduction" loans. In a "direct reduction" loan the debt is paid by equal periodic payments although varying portions of each payment are applied toward principal and interest.

() 2. The interest is paid first, and then the remainder of the payment is used to reduce the debt. As the debt (or remaining balance) is reduced with each payment, so is the amount of interest to be paid. With a smaller portion of each payment being deducted for interest, the amount remaining to pay off the balance increases.

() 3. The breakdown of each payment into the interest portion and the principal reduction portion is called an amortization schedule. The word amortization comes from the French "a mort" meaning "at the point of death." Likewise, you are "killing" a loan by paying it off.

() 4. The amortization of a mortgage can be represented by the following figure:

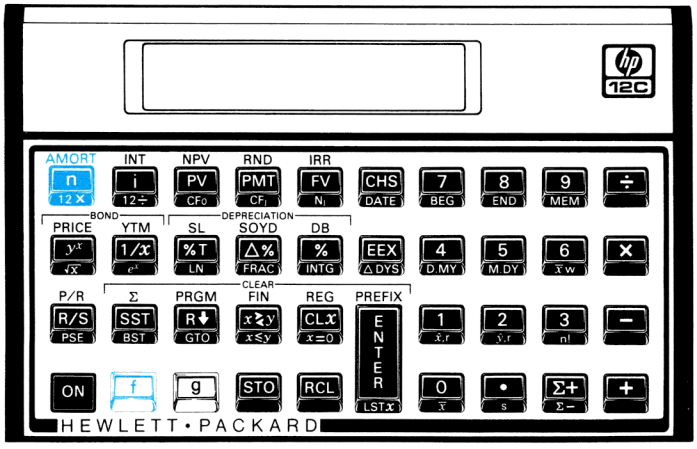


Mortgage Amortization Diagram

Figure 33

As you reduce the size of the loan, the amount of interest decreases ... and a gradually larger portion of each payment goes toward the reduction of the debt itself (the outstanding principal). By the time you reach your last payment, very little is deducted for interest.

() 5. The HP-12C enables you to calculate the amounts applied to the reduction of principal and to the interest, as well as the remaining balance on the loan after the payment has been made, using the [f][AMORT] function.



Location of [f] [AMORT]

Figure 34

() 6. Example: For a house you are about to buy, you can obtain a 29-year

mortgage for $61,000 at 14.5% annual interest. The monthly payment is made at the end of the month. Find the amounts that would be applied to interest and to principal for each of the first two payments.

Keystrokes	Display	
[f] CLEAR [FIN]		The financial registers are cleared.
[g] [END]		END mode is set.
29 [g] [12x]	348.00	The total number of payments is calculated and stored.
14.5 [g] [12/]	1.21	The monthly interest rate is calculated and stored.
61000 [PV]	61,000.00	The loan amount is stored.
[PMT]	-748.54	The monthly payment is calculated.
0 [n]	0.00	The n-register is cleared.
1	1.	The number of months to be amortized is keyed in.
[f] [AMORT]	-737.08	The amount of interest on the first payment is calculated.
[x<>y]	-11.46	The amount of principal reduction from the first payment is displayed.
1 [f] [AMORT]	-736.94	The amount of interest on the second payment is calculated.
[x<>y]	-11.60	The amount of principal reduction from the second payment is displayed.

() 7. What is the remaining balance on the loan after the first two payments?

Keystrokes	Display	
[RCL] [PV]	60,976.94	The remaining balance is displayed.

() 8. To display the total number of payments amortized so far, press:

Keystrokes	Display	
[RCL] [n]	2.00	The number of months amortized is displayed.

() 9. Notice that you can recall the numbers stored in the financial registers using [RCL] just as you can recall numbers stored in any other register. Remember, when you recall a number stored in a register, the number in the register is unchanged. [RCL] simply copies the number from the register into the display.

()10. In summary, to obtain an amortization schedule:

1. Press [f] CLEAR [FIN] to clear the financial registers.
2. Set the payment mode ([g] [END] or [g] [BEG]).
3. Store the total number of periods using [n] or [g] [12x].
4. Store the periodic interest rate using [i] or [g] [12/].
5. Store the amount of the loan (the principal) using [PV].
6. Press [PMT] to calculate the periodic payment amount.
7. Press 0 [n].
8. Key in the number of payments to be amortized.
9. Press [f] [AMORT] to calculate and display the amount applied to interest from those payments.
10. Press [x<>y] to display the amount applied to principal from those payments.
11. To display the remaining balance on the loan, press [RCL] [PV].
12. To display the total number of payments amortized, press [RCL] [n].

()11. For tax purposes, you would like to know how much interest you will pay during your first year (12 payments) of home ownership. You have a 29 year, $56,300 mortgage at 14.2%.

Keystrokes	Display	
[f] CLEAR [FIN]		The financial registers are cleared.
29 [g] [12x]	348.00	The total number of payments is calculated and stored.

14.2 [g] [12/]	1.18	The monthly interest rate is calculated and stored.
56300 [PV]	56,300.00	The mortgage amount is stored.
[PMT]	-677.51	The payment amount is calculated.
0 [n]	0.00	The n-register is cleared.
12 [f] [AMORT]	-7,985.43	The amount of interest paid over the first 12 months is calculated.

()12. In the previous example, how much principal is paid?

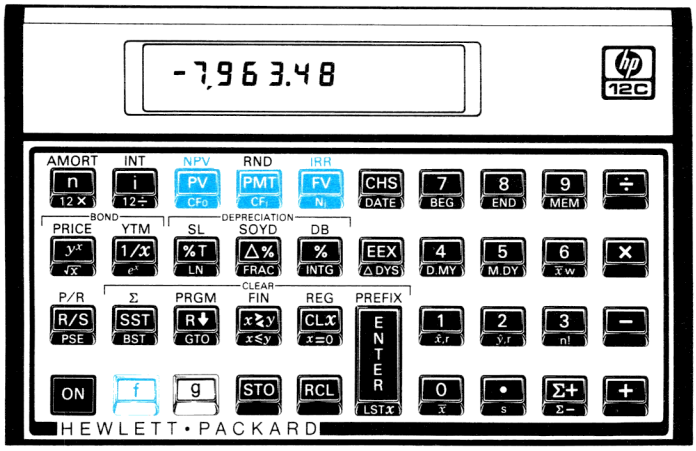
Keystrokes	Display	
[x<>y]	-144.69	The amount of principal paid over the first 12 months is calculated.

()13. How much interest would be paid during the second year (the next 12 months)?

Keystrokes	Display	
12 [f] [AMORT]	-7,963.48	The interest paid during year 2 (the second 12 months) is calculated.

Discounted Cash Flow Analysis

()14. Discounted cash flow analysis is a way of evaluating investment alternatives on the same basis -- their present value. The HP-12C provides functions for the two most widely-used methods of discounted cash flow analysis: the net present value (NPV) approach and the internal rate of return (IRR) approach. Here is where these keys are located on the keyboard, including the necessary keys for storing information.



Locations of [f][NPV], [f][IRR], [g][CFo], [g][CFj], and [g][Nj]

Figure 35

()15. To this point you have been working problems involving only even cash flow series (except for the initial cash flow (PV) and the final cash flow (FV), each payment amount is the same). NPV and IRR enable you to analyze financial problems involving UNEVEN cash flows occurring at REGULAR intervals. Problems involving even or uneven cash flows occurring at irregular intervals are not covered in this guide. As in compound interest calculations, the interval between cash flows can be any time period.

()16. Assuming a minimum desired yield (financial objective), the net present value method finds the present value of the future cash flows and adds this value to the initial investment (the cash flow sign convention is used).

()17. If this net present value is greater than zero, the transaction meets your financial objectives. If the net present value is less than zero, the investment is not attractive.

()18. A comparison of the NPV's of alternative investment possibilities indicates which of them is most desirable: the greater the NPV, the more attractive the investment.

()19. Example: You have an opportunity to invest in a rental unit which requires a $70,000 down payment. If the annual cash flows are projected as follows, and you desire a 17% annual yield, should you invest in the property?

Year	Cash Flow	
0	-70,000	
1	-3,500	
2	8,100	
3	16,600	
4	107,500	(income + gain from sale of property)

The cash flow diagram looks like this:

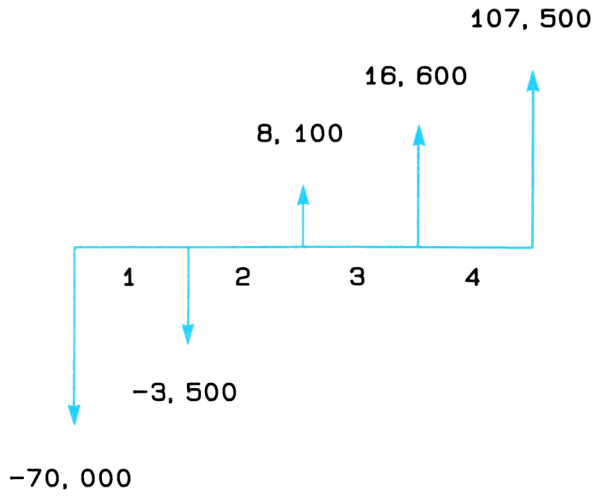


Figure 36

Keystrokes	Display	
[f] CLEAR [REG]	0.00	The storage registers are cleared, including the financial registers.
70000 [CHS] [g] [CFo]	-70,000.00	The initial investment is stored.
3500 [CHS] [g] [CFj]	-3,500.00	
8100 [g] [CFj]	8,100.00	The cash flows are stored.
16600 [g] [CFj]	16,600.00	
107500 [g] [CFj]	107,500.00	
17 [i]	17.00	The desired yield is stored.
[f] [NPV]	657.64	The net present value is calculated.

Since the NPV is positive, the investment exceeds the objective of a 17% return.

()20. The j in [CFj] means any cash flow except the initial investment. The initial investment (cash flow zero) is stored by pressing [g] [CFo]. When you store the first cash flow, you can think of j taking the value 1. When you store the second cash flow, j takes the value 2, and so on. It turns out that these numbers, 0, 1, 2 and so on, have a very straight-forward meaning. They simply refer to the storage registers into which the dollar amounts are automatically stored by the HP-12C. Perform the following keystrokes to confirm this.

()21.

Keystrokes	Display	
[RCL] 0	-70,000.00	The initial investment.
[RCL] 1	-3,500.00	The first cash flow.
[RCL] 2	8,100.00	The second cash flow.
[RCL] 3	16,600.00	The third cash flow.
[RCL] 4	107,500.00	The fourth cash flow.

()22. Knowing where your cash flows are stored makes it easy to check the accuracy of your entries and to correct any that are wrong. For instance, in the example above, if 7100 had been entered incorrectly as the second cash flow, the keystrokes 8100 [STO] 2 would correct your mistake.

()23. A maximum of 21 cash flow amounts (including the initial investment CFo) can be stored in the HP-12C.* The first 20 cash flows are stored in the 20 general purpose storage registers, and if there is a 21st cash flow, it is stored in the FV financial register. Problems involving more than 21 cash flows can be handled if, among the cash flows, there are consecutive cash flows of the same amount (that is, a group of equal cash flows). Each group can contain a maximum of 99 equal cash flows.

()24. Example: An investor has an opportunity to purchase a piece of property for $70,000 down. If the after-tax monthly cash flows are as follows, should the investor purchase the property if he desires a 15% rate of return?

Group (j)	Cash Flow (CFj)	Number of Months (Nj)	
0	-70,000	1	
1	-1,000	2	
2	800	56	
3	87,500	1	(income + gain from sale of property)

()25. The number of consecutive times each cash flow occurs is designated Nj, corresponding to cash flow amount CFj, and is entered using the [g][Nj] key. Here is how the previous problem is solved:

Keystrokes	Display	
[f] CLEAR [REG]	0.00	The storage registers are cleared, including the financial registers.
70000 [CHS]		
[g] [CFo]	-70,000.00	The initial investment is stored.

---

* This assumes that there are a maximum of 8 instructions in program memory.

1000 [CHS] [g] [CFj]	-1,000.00	The first cash flow is stored.
2 [g] [Nj]	2.00	The number of cash flows in the first group is stored.
800 [g] [CFj]	800.00	The second cash flow is stored.
56 [g] [Nj]	56.00	The number of cash flows in the second group is stored.
87500 [g] [CFj]	87,500.00	The final cash flow is stored.
15 [g] [12/]	1.25	The monthly desired yield is stored.
[f] [NPV]	1,373.74	The NPV is calculated.

Since the final NPV is positive, the investment meets the 15% objective.

()26. In summary, to enter the amounts of the cash flows and the number of times they occur:

1. Press [f] CLEAR [REG] to clear all of the storage registers, including the financial registers.
2. Key in the amount of the initial investment (press [CHS] if the cash flow is negative) and press [g] [CFo].
3. If the initial investment consists of more than one cash flow of the amount entered in step 2, key in the number of those cash flows and press [g] [Nj]. The calculator assumes that No is 1 if [g] [Nj] is not pressed.
4. Key in the amount of the next cash flow (press [CHS] if the cash flow is negative) and press [g] [CFj].
5. If the amount entered in step 4 occurs more than once, key in the number of those cash flows and press [g] [Nj]. If [g] [Nj] is not pressed, the calculator assumes that Nj is 1 for the CFj just entered.
6. Repeat steps 4 and 5 until all cash flows have been entered.

()27. With the amounts of the cash flows stored in the calculator, you can calculate NPV as follows:

1. Enter the periodic interest rate using [i] or [g] [12/].

2. Press [f] [NPV].

()28. Example: An investor has an opportunity to purchase a piece of property for $87,000 down and he would like a 17% return. If the quarterly cash flows are as follows, should the investor purchase the property?

Group (j)	Cash Flow (CFj)	Number of Quarters (Nj)	
0	-87,000	1	
1	3,500	8	
2	3,000	12	
3	2,500	4	
4	110,000	1	(income + gain from sale of property)

Keystrokes	Display	
[f] CLEAR [REG]	0.00	The storage registers are cleared.
87000 [CHS]		
[g] [CFo]	-87,000.00	The investment is stored.
3500 [g] [CFj]	3,500.00	The second cash flow is stored.
8 [g] [Nj]	8.00	The number of cash flows in the second group is stored.
3000 [g] [CFj]	3,000.00	The third cash flow is stored.
12 [g] [Nj]	12.00	The number of times this cash flow occurs is stored.
2500 [g] [CFj]	2,500.00	The fourth cash flow is stored.
4 [g] [Nj]	4.00	The number of times this cash flow occurs is stored.
110000 [g] [CFj]	110,000.00	The final cash flow is stored.

17 [ENTER] 4 [/]	4.25	
[i]	4.25	The quarterly interest rate is calculated and stored.
[f] [NPV]	-1,001.79	The NPV is calculated.

Since the NPV is negative, the investment does not meet the 17% objective.

()29. The internal rate of return -- the IRR -- is the rate for which the NPV equals zero. Rather than comparing the NPV's of alternative investment possibilities, you may want to compare their rates of return -- that is, their IRR's -- or you may want to determine the IRR of a single investment plan. (IRR assumes that all cash flows are re-invested at the internal rate of return.)

()30. To calculate the internal rate of return of the previous example press:

Keystrokes	Display	
[f] [IRR]	4.18	The quarterly IRR is calculated (in approximately 30 seconds).
4 [x]	16.71	The annual rate of return is displayed.

()31. The calculator may take several seconds or even minutes to produce an answer for IRR. This is because the mathematical calculations for finding IRR are extremely complex, involving a series of successive calculations.

()32. Calculate the internal rate of return (IRR) as follows:

1. Enter the cash flows using the method described in step 26. The cash flow sequence must contain at least one sign change. In other words, if the first several cash flows are negative, and they are followed by all positive values, that counts as one sign change. Cash flows with multiple sign changes may have multiple answers.

2. Press [f] [IRR].

The calculated answer is the periodic rate of return. If the cash flow periods are other than annual (for instance monthly or quarterly) the answer should be multiplied by the number of periods per year to determine the nominal annual internal rate of return, also called the annual percentage rate or APR.*

()33. Example: An investment proposal calls for an increasing outlay of cash for each of 5 years and then a substantial payoff. If the annual cash flows are as follows, what is the return on the investment?

Year (j)	Cash Flow (CFj)
0	-2,000
1	-2,500
2	-3,000
3	-3,500
4	-4,000
5	25,000

Keystrokes	Display	
[f] CLEAR [REG]	0.00	The storage registers are cleared.
2000 [CHS] [g] [CFo]	-2,000.00	
2500 [CHS] [g] [CFj]	-2,500.00	
3000 [CHS] [g] [CFj]	-3,000.00	The cash flows are stored.
3500 [CHS] [g] [CFj]	-3,500.00	
4000 [CHS] [g] [CFj]	-4,000.00	

---

* See "Nominal Rate Converted to Effective Rate" in Section 15 of the HP-12C Owner's Handbook and Problem-Solving Guide to convert this rate to the effective annual interest rate.

25000 [g][CFj]	25,000.00	The final cash flow is stored.
[f] [IRR]	19.71	The rate of return is calculated.

Since the cash flows occur annually, the result is both the nominal interest rate (the APR) and the effective interest rate.

Chapter 4 Summary

* [f] [AMORT] calculates the amount of interest and principal for each payment. Reference: Pages 4-61 - 4-63, steps 5-10.

* [f] [NPV] determines the net present value of a series of uneven cash flows. Reference: Page 4-65 and 4-68 - 4-69, steps 16-19, 25-27.

* [g] [CFo] is used to enter the initial cash flow. Reference: Page 4-67, step 20.

* [g] [CFj] is used to enter cash flows 1 to j. Reference: Page 4-67, step 20.

* [g] [Nj] is used to enter the number of times each cash flow occurs. Reference: Page 4-68, step 25.

* [f] [IRR] calculates the internal rate of return of a series of uneven cash flows. Reference: Pages 4-71 - 4-73, steps 29, 32-33.

Review Test for Chapter 4

The answers are on Page 4-77, immediately following this review test.

1. Generate an amortization schedule for the first two payments of an $80,000 loan with monthly payments (at the end of the month) of $916.33 at an annual interest rate of 13.5%. Then find the remaining balance after the second payment.

Keystrokes	Display

2. Generate a yearly amortization schedule for the first two years of a $25,000 loan at 10% with monthly payments of $330.38 (END). What is the remaining balance at the end of the second year?

Keystrokes	Display

3. You have an opportunity to purchase a duplex for $80,000 and would like at least a 13% return. You expect to keep the duplex for 5 years and then sell it for $125,000. Assuming the following yearly cash flows, calculate the NPV to determine whether the investment meets your profit objective of a 13% return.

Year (j)	Cash Flow (CFj)	
0	-80,000	
1	-500	
2	4,500	
3	5,500	
4	4,500	
5	5,000	+ 125,000 (property sold)

Keystrokes	Display

4. In the previous example, what is the yield?

Keystrokes	Display

Answers to Review Test for Chapter 4

1.

Keystrokes	Display	Reference
[f] CLEAR [FIN]		(Page 4-63, step 10)
[g] [END]		
80000 [PV]	80,000.00	
916.33 [CHS] [PMT]	-916.33	
13.5 [g] [12/]	1.13	
1 [f] [AMORT]	-900.00	
[x<>y]	-16.33	
1 [f] [AMORT]	-899.82	
[x<>y]	-16.51	
[RCL] [PV]	79,967.16	

2.

Keystrokes	Display	Reference
[f] CLEAR [FIN]		(Pages 4-63 - 4-64, steps 11-13)
25000 [PV]	25,000.00	
10 [g] [12/]	0.83	
330.38 [CHS] [PMT]	-330.38	
12 [f] [AMORT]	-2,430.97	
[x<>y]	-1,533.59	
12 [f] [AMORT]	-2,270.39	
[x<>y]	-1,694.17	
[RCL] [PV]	21,772.24	

3.

Keystrokes	Display	Reference
[f] CLEAR [REG]	0.00	(Page 4-69, steps 26-27)
80000 [CHS] [g] [CFo]	-80,000.00	
500 [CHS] [g] [CFj]	-500.00	
4500 [g] [CFj]	4,500.00	
5500 [g] [CFj]	5,500.00	
4500 [g] [CFj]	4,500.00	
125000 [ENTER]	125,000.00	
5000 [+] [g] [CFj]	130,000.00	
13 [i]	13.00	
[f] [NPV]	212.18	Since the NPV is positive, your profit objective is realized.

4.

Keystrokes	Display	Reference
[f] [IRR]	13.06	(Page 4-72, step 32)

NOTES

Depreciation Calculations

Preview

In Chapter 5 you will:

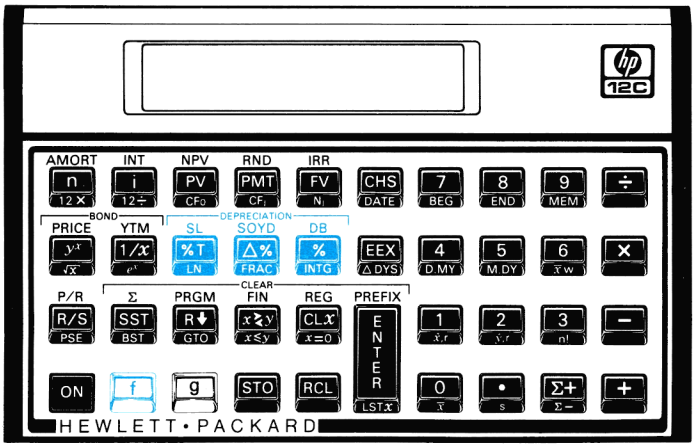
* Learn about three types of depreciation:

  . Straight-line.
  . Sum-of-the-years-digits.
  . Declining balance.

() 1. Tangible assets such as buildings, machines, tools, trucks, etc. typically decline in value over time through usage, technological obsolescence, environmental deterioration or a combination of all of these.

() 2. Depreciation is a method of periodically accounting for the declining value of an asset.

() 3. The HP-12C has keys for the three most common arithmetic formula depreciation methods: straight-line ([SL]), sum-of-the-years-digits ([SOYD]) and declining-balance ([DB]).*



Locations of [f][SL], [f][SOYD], and [f][DB]

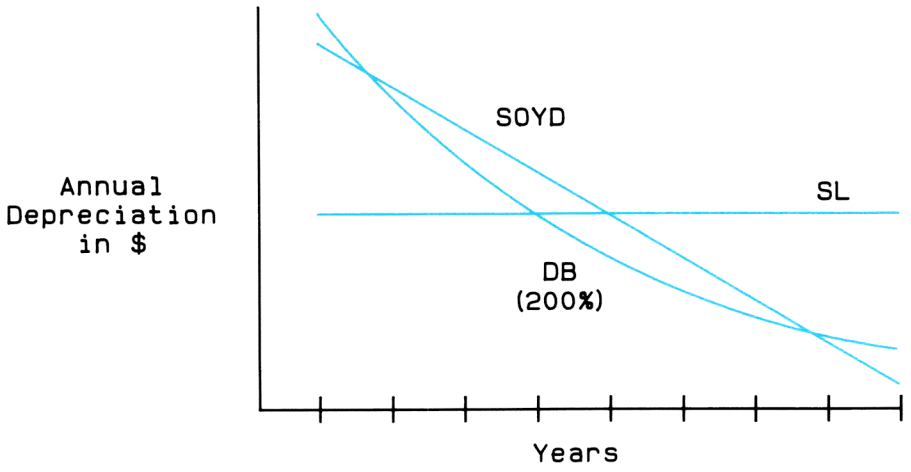
Figure 37

---

* The depreciation keys do not meet the requirements of the Federal tax policy in effect in 1982, which dictates that tables published by the IRS are to be used to determine deductions for tax purposes.

() 4. Sum-of-the-years-digits and declining-balance are methods of accelerated depreciation whereby higher annual amounts of depreciation are charged during the early years of an asset's life than with the straight-line depreciation method, reflecting the fact that many assets decline in value most during the early part of their lives.

() 5. When the annual amount of depreciation for each of the three methods is plotted versus time, the graph looks like this:



Comparing Depreciation Methods

Figure 38

() 6. Example: The Drifter Apartments have a depreciable value of $126,000. The owner wishes to use 125% declining-balance depreciation over 20 years. Assuming zero salvage value after 20 years, what is the annual depreciation allowance and remaining depreciable value in year 1?

Keystrokes	Display	
[f] CLEAR [FIN]		The financial registers are cleared.
126000 [PV]	126,000.00	The depreciable value is stored.
0 [FV]	0.00	The salvage value is stored.
20 [n]	20.00	The useful life is stored.
125 [i]	125.00	The declining-balance factor is stored.
1 [f] [DB]	7,875.00	The amount of depreciation in the first year is calculated.

[x<>y]	118,125.00	The remaining depreciable value after the first year is displayed.

() 7. How does this compare with sum-of-the-years-digits and straight-line depreciation in year 1?

Keystrokes	Display	
1 [f] [SOYD]	12,000.00	The amount of depreciation in the first year is calculated.
[x<>y]	114,000.00	The remaining depreciable value after the first year is displayed.
1 [f] [SL]	6,300.00	The amount of depreciation in the first year is calculated.
[x<>y]	119,700.00	The remaining depreciable value after the first year is displayed.

() 8. The HP-12C enables you to calculate the amount of depreciation and the remaining depreciable value (book value minus salvage value) for three depreciation methods. Use the following procedures:

1. Press [f] CLEAR [FIN].
2. Key in the original cost of the asset and press [PV]. (The cash flow sign convention is not observed.)
3. Key in the salvage value of the asset and press [FV]. If the salvage value is zero, press 0 [FV].
4. Key in the expected useful life of the asset in years and press [n].
5. If the declining-balance method is used, key in the declining-balance factor (as a percentage) and press [i]. For example, 1 1/4 times the straight-line rate --- 125 percent declining-balance --- would be keyed in as 125 [i].
6. Key in the number of the year for which depreciation is to be calculated.
7. Press:

   * [f] [SL] for straight-line depreciation.

* [f] [SOYD] for sum-of-the-years-digits depreciation.

* [f] [DB] for declining-balance depreciation.

The amount of depreciation is in the display. To display the remaining depreciable value (the book value less the salvage value) after the depreciation has been calculated, press [x<>y].

() 9. Example: A computer system purchased for $118,000 is depreciated over 5 years using the SOYD method. The estimated salvage value is $10,000. Find the depreciation and remaining depreciable value for each year of the system's useful life.

Keystrokes	Display	
[f] CLEAR [FIN]		The financial registers are cleared.
118000 [PV]	118,000.00	The original cost is stored.
10000 [FV]	10,000.00	The salvage value is stored.
5 [n]	5.00	The useful life is stored.
1 [f] [SOYD]	36,000.00	The amount of depreciation in the first year is calculated.
[x<>y]	72,000.00	The remaining depreciable value after the first year is displayed.
2 [f] [SOYD]	28,800.00	The second year's depreciation is calculated.
[x<>y]	43,200.00	The remaining depreciable value after the second year is displayed.
3 [f] [SOYD]	21,600.00	The third year's depreciation is calculated.
[x<>y]	21,600.00	The remaining depreciable value after the third year is displayed.
4 [f] [SOYD]	14,400.00	The fourth year's depreciation.

[x<>y]	7,200.00	The remaining depreciable value.
5 [f] [SOYD]	7,200.00	The fifth year's depreciation.
[x<>y]	0.00	The remaining depreciable value.

()10. Now calculate a 5-year straight-line depreciation schedule for the same computer system.

Your HP-12C already contains all of the necessary values, so just press [f] [SL] to see the alternative depreciation.

Keystrokes	Display	
1 [f] [SL]	21,600.00	The first year's depreciation is calculated.
[x<>y]	86,400.00	The remaining depreciable value after the first year is displayed.
2 [f] [SL]	21,600.00	The second year's depreciation is calculated.
[x<>y]	64,800.00	The remaining depreciable value is displayed.
3 [f] [SL]	21,600.00	The third year's depreciation is calculated.
[x<>y]	43,200.00	The remaining depreciable value is displayed.
4 [f] [SL]	21,600.00	The fourth year's depreciation
[x<>y]	21,600.00	The remaining depreciable value.
5 [f] [SL]	21,600.00	The fifth year's depreciation.
[x<>y]	0.00	The remaining depreciable value.

()11. Calculate a 5-year, 150% declining-balance depreciation schedule for the same computer system.

Keystrokes	Display	
150 [i]	150.00	The declining-balance factor is stored.
1 [f] [DB]	35,400.00	The first year's depreciation is calculated.
[x<>y]	72,600.00	The remaining depreciable value after the first year is displayed.
2 [f] [DB]	24,780.00	The second year's depreciation.
[x<>y]	47,820.00	The remaining depreciable value after the second year.
3 [f] [DB]	17,346.00	The third year's depreciation.
[x<>y]	30,474.00	The remaining depreciable value after the third year.
4 [f] [DB]	12,142.20	The fourth year's depreciation.
[x<>y]	18,331.80	The remaining depreciable value after the fourth year.
5 [f] [DB]	18,331.80	The fifth year's depreciation.
[x<>y]	0.00	The remaining depreciable value after the fifth year.

Chapter 5 Summary

* [f] [SL] computes the amount of depreciation on a straight-line basis. Reference: Pages 5-80 - 5-82, steps 3-8.

* [f] [DB] computes the amount of declining balance depreciation. Reference: Pages 5-80 - 5-82, steps 3-8.

* [f] [SOYD] computes the amount of depreciation using the sum-of-the-years-digits method. Reference: Pages 5-80 - 5-82, steps 3-8.

Review Test for Chapter 5

The answers are on Page 5-88, immediately following this review test.

1. A property has been acquired for $250,000. The purchase price is allocated to $50,000 for land (non-depreciable) and $200,000 for improvements (building, etc.). The remaining useful life of the building is determined to be 30 years with no estimated salvage value. Calculate the amount of depreciation and the remaining depreciable value for each of the first 2 years assuming 150% declining balance.

Keystrokes	Display

Answers to Review Test for Chapter 5

1. Keystrokes	Display	Reference
[f] CLEAR [FIN]		(Page 5-82, step 8)
200000 [PV]	200,000.00	
30 [n]	30.00	
0 [FV]	0.00	
150 [i]	150.00	
1 [f] [DB]	10,000.00	Amount of depreciation in year 1.
[x<>y]	190,000.00	Remaining depreciable value at end of year 1.
2 [f] [DB]	9,500.00	Amount of depreciation in year 2.
[x<>y]	180,500.00	Remaining depreciable value at end of year 2.

NOTES

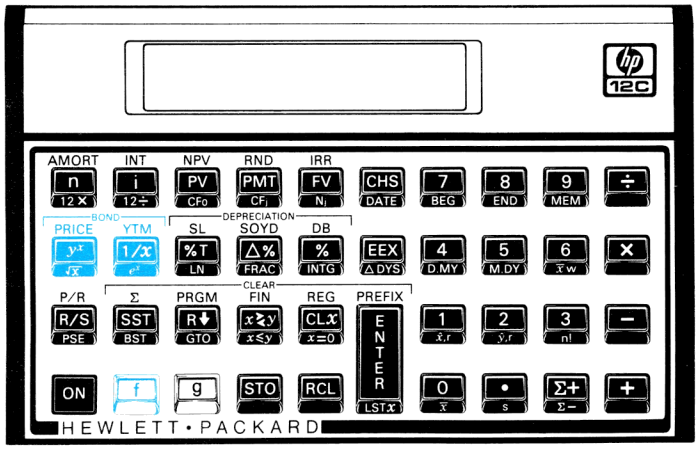
Bond Calculations

Preview

In Chapter 6 you will:

* Perform bond price and yield computations.

() 1. The HP-12C has two keys dedicated to bond calculations: [PRICE] (price) and [YTM] (yield to maturity).



Locations of [f][PRICE] and [f][YTM]

Figure 39

() 2. A bond is a written agreement to pay periodic interest payments, called coupons, for a specified period of time, plus an amount to be paid when the bond matures (the redemption value).

() 3. When you purchase a bond, you are buying the right to receive a number of future cash flows.

() 4. The price of a bond is expressed as a percentage of the dollar value.

() 5. Conventional U.S. bonds pay interest payments (coupons) every 6 months. This convention of semi-annual coupons is assumed in the HP-12C's bond calculations.

() 6. The redemption value of a bond is assumed to be 100% of $1000.

() 7. For example, an investor who on January 15, 1981 purchased a $1000, 14 1/2% bond redeemable on July 15, 1991 will receive:

a. 21 semi-annual payments of $72.50, the first one received on July 15, 1981.

b. $1000 on July 15, 1991.

The cash flow diagram would look like this:

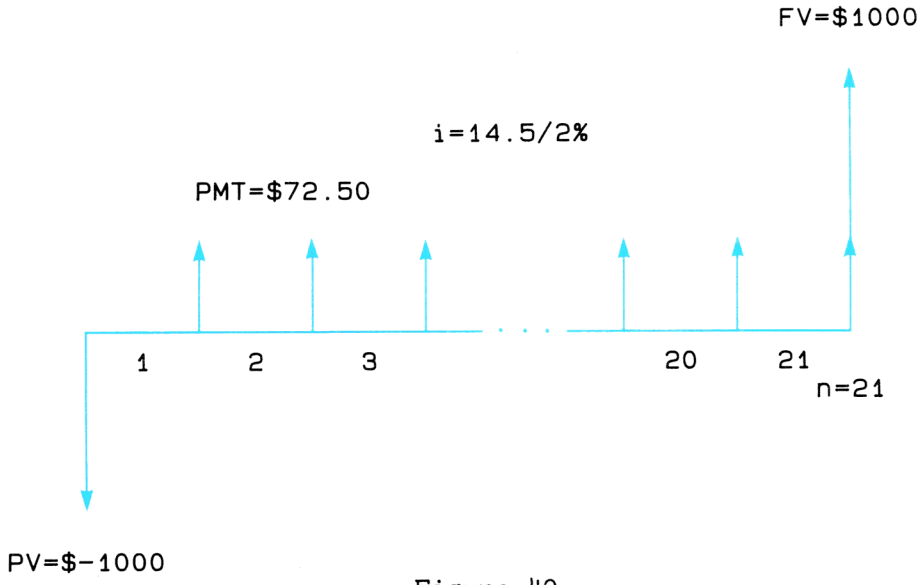


Figure 40

() 8. However, unlike the previous example, most bonds are not purchased on an interest or coupon payment date. When a bond is purchased between coupon dates, a portion of the next coupon is paid to the seller of the bond.

() 9. For example, if a bond is sold after three-fourths of the coupon period has passed, the seller would receive three-fourths of the next coupon payment. The buyer pays the price of the bond plus three-fourths of the next coupon --- this amount is called the accrued interest.

()10. The generalized bond cash flow diagram looks like this:

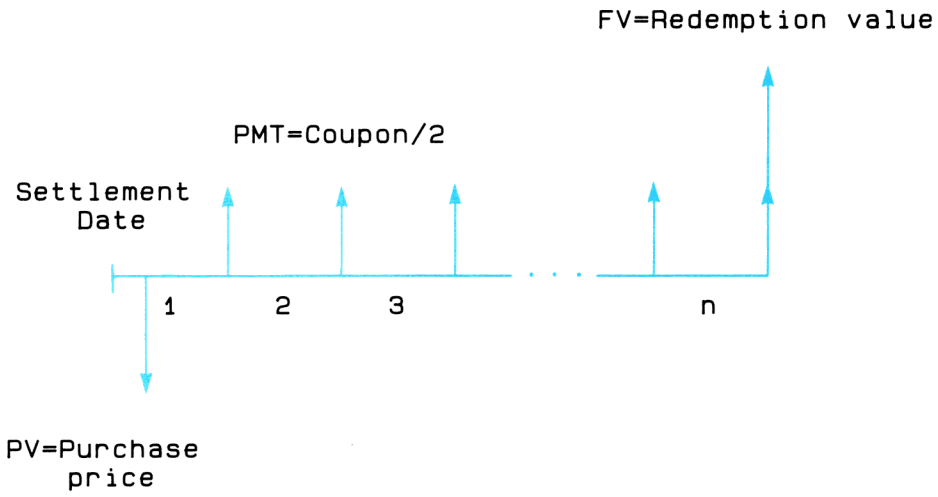


Figure 41

()11. All bond calculations on the HP-12C assume an actual calendar year. Bonds of this type include U.S. Treasury Bonds and Notes, Treasury Certificates of Indebtedness, and FHA Debentures. Bonds based on a 360-day calendar year (corporate bonds, municipal bonds, etc.) must be evaluated using a program (see Section 16 of the HP-12C Owner's Handbook and Problem-Solving Guide).

()12. Example: What price should you pay on January 12, 1982 for a 13 3/4% bond that matures on June 1, 1996, if you desire a yield of 14 1/2%?

Keystrokes	Display	
[f] CLEAR [FIN]		The financial registers are cleared. *
[g] [M.DY]		The calendar format is set to "month, day, year."
14.5 [i]	14.50	The yield to maturity is stored.
13.75 [PMT]	13.75	The coupon rate is stored.

---

* The bond calculations do not require you to clear any registers. However, as a general routine, you might wish to clear the financial registers before starting any financial calculation.

1.121982 [ENTER]	1.12	The settlement date is entered. *
6.011996	6.011996	The maturity date is keyed in.
[f] [PRICE]	95.48	The bond price is calculated.
[x<>y]	1.59	The accrued interest is displayed.
[+]	97.06	The total price, including accrued interest, is calculated. Remember that this price is expressed as a percentage.

()13. Use the following procedures to determine the price of a bond.

1. Press [f] CLEAR [FIN].
2. Set the calendar format to [M.DY].
3. Key in the desired yield to maturity and press [i].
4. Key in the annual coupon rate (as a percentage) and press [PMT].
5. Key in the settlement (purchase) date in the format MM.DDYYYY and press [ENTER].
6. Key in the maturity (redemption) date in the format MM.DDYYYY.
7. Press [f] [PRICE]. The price is shown in the display.

   (Optional) Press [x<>y] to display the amount of accrued interest.
8. Press [+] to add the interest to the price and determine the total price to be paid.

()14. Given the following U.S. Treasury Bond, find its total price (including accrued interest):

Settlement date October 1, 1981; maturity date December 15, 1990; coupon rate 14%; yield to maturity 15.75%.

---

* Remember from Chapter 2 (step 22) that although the entire number is stored in the calculator, it is displayed with only 2 decimal places.

Keystrokes	Display	
[f] CLEAR [FIN]	97.06	The financial registers are cleared.
15.75 [i]	15.75	The yield is stored.
14 [PMT]	14.00	The coupon rate is stored.
10.011981 [ENTER]	10.01	The settlement date is entered.
12.151990	12.151990	The maturity date is keyed in.
[f] [PRICE]	91.58	The price is calculated.
[+]	95.71	The total purchase price is calculated.

()15. The market is quoting 96 3/8 for the bond described in the preceding example. What yield will that provide?

Keystrokes	Display	
3 [ENTER] 8 [/]	0.38	
96 [+]	96.38	The price is calculated.
[PV]	96.38	The price is stored.
		The coupon rate is still stored in the [PMT] register, so it does not need to be re-entered.
10.011981 [ENTER]	10.01	The settlement date is entered.
12.151990	12.151990	The maturity date is keyed in.
[f] [YTM]	14.72	The percent yield is calculated.

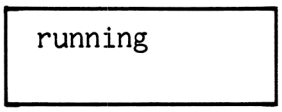
()16. To determine the yield to maturity of a bond, use the following procedure:

1. Key in the quoted price (as a percent of 100) and press [PV].
2. Key in the annual coupon rate and press [PMT].
3. Key in the settlement (purchase) date in the format MM.DDYYYY and press [ENTER].

4. Key in the maturity (redemption) date in the format MM.DDYYYY.

5. Press [f] [YTM]. The percent yield to maturity is shown in the display.

   Note: The [YTM] function may take a significant amount of time to produce an answer, during which the calculator displays



()17. Find the yield of the following U.S. Treasury Note:

Settlement date August 18, 1981; maturity date January 1, 1987; interest rate 14.25% (coupon); price 99.52.

Keystrokes	Display	
[f] CLEAR [FIN]	14.72	The financial registers are cleared.
99.52 [PV]	99.52	The price is stored.
14.25 [PMT]	14.25	The coupon is stored.
8.181981 [ENTER]	8.18	The settlement date is entered.
1.011987	1.011987	The maturity date is keyed in.
[f] [YTM]	14.37	The percent yield is calculated.

Chapter 6 Summary

* A bond pays coupons every 6 months for a pre-determined period of time, and pays 100 (100% of $1000) at the maturity date.
Reference: Pages 6-90 - 6-91, steps 2-3, 5-6.

* [f] [PRICE] determines the price of a bond and the amount of accrued interest. Reference: Pages 6-92 - 6-93, steps 12-14.

* [f] [YTM] determines the yield-to-maturity of a bond.
Reference: Pages 6-94 - 6-95, steps 15-17.

Review Test for Chapter 6

The answers are on Page 6-98, immediately following this review test.

1. What price (including accrued interest) should you pay on September 28,1981 for a bond that matures on June 1, 1995, and pays a coupon of 15 3/4% if you wish a yield of 17%?

   Keystrokes Display

2. If the above bond is purchased for 95 what is the yield?

   Keystrokes Display

Answers to Review Test for Chapter 6

1. Keystrokes	Display	Reference
17 [i]	17.00	(Page 6-93, step 13)
15.75 [PMT]	15.75	
9.281981 [ENTER]	9.28	
6.011995 [f] [PRICE]	93.36	
[+]	98.48	Price including accrued interest.

2. Keystrokes	Display	Reference
95 [PV]	95.00	(Page 6-94, step 16)
9.281981 [ENTER]		
6.011995 [f] [YTM]	16.68	Percent yield to maturity.

NOTES

What is a Program?

Preview

In Chapter 7 you will:

* Learn what a program is and the advantages of programming.

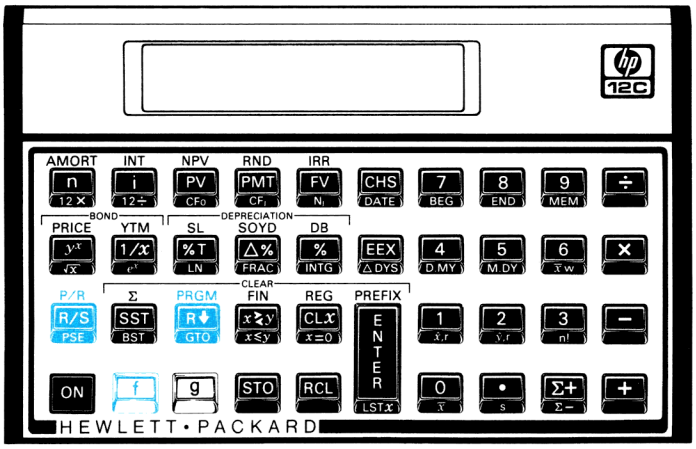
* Create and run a simple program.

() 1. A program is a sequence of keystrokes that is remembered by the calculator.

() 2. When you need to repeat the same sequence of keystrokes several times, a program could save you a great deal of time.

() 3. Instead of pressing all the keys each time, you only need to press one key to start the program --- the calculator does the rest.

() 4. The HP-12C has three keys which are necessary to key in and run a program: [f][P/R] (to set the calculator to program mode or run mode), [f] CLEAR [PRGM] (to clear program memory), and [R/S] (to run (start) and stop a program).



Locations of [f][P/R], [f] CLEAR [PRGM], and [R/S]

Figure 42

() 5. Example: An office supply dealer is selling selected stock at 25% off. An additional $5 handling charge is to be added to each transaction. Create a program which calculates the net cost of an item after the discount is subtracted and the handling charge is added.

First, write down the steps to manually calculate the net cost of an item listing for $300 (this will also serve as a check solution after the program is written).

Keystrokes	Display	
300 [ENTER]	300.00	The cost of the item is keyed in and separated from the next entry.
25 [%]	75.00	The amount of discount is calculated.
[-]	225.00	The price less discount is calculated.
5	5.	The handling charge is keyed in.
[+]	230.00	The net cost (price less discount plus handling charge) is calculated.

Next, set the calculator to program mode and erase any program(s) already stored:

Keystrokes	Display	
[f] [P/R]	00-	Program mode is set. Notice the program mode annunciator (PRGM) in the display.
[f] CLEAR [PRGM]	00-	Previous programs are cleared. *

Finally, press the keys that you used above to solve the program manually. Do not key in 300 as this number will vary each time the program is used. (Don't be concerned about what appears in the display as you press the keys - you will learn about these keycodes in Chapter 8.)

---

* You must be in program mode for [f] CLEAR [PRGM] to clear previous programs.

Keystrokes	Display		
[ENTER]	01-	36	Program line number and keycode (position of key)
2	02-	2	
5	03-	5	
[%]	04-	25	
[-]	05-	30	
5	06-	5	
[+]	07-	40	

Now run the program above using the check solution calculated in step 5.

Keystrokes	Display	
[f][P/R]	230.00	Run (calculator) mode is set. The display shows the number previously calculated.
300	300.	The cost is keyed in.
[R/S]	230.00	The net cost is calculated.

() 6. Calculate the net cost of a typewriter listed for $895.

Keystrokes	Display	
895	895.	The cost of the typewriter is keyed in.
[R/S]	676.25	The net cost of the typewriter is calculated, and agrees with the check solution.

() 7. What is the net cost of an executive chair listing for $189?

Keystrokes	Display	
189	189.	The cost of the chair is keyed in.
[R/S]	146.75	The net cost of the chair is calculated.

() 8. To create a program:

1. Write down the sequence of keystrokes that you would use to do the desired calculation.

2. Press [f] [P/R] to set the calculator to program mode. The program status indicator (PRGM) is displayed when the calculator is in program mode.

3. Press [f] CLEAR [PRGM] to erase any previous programs that may be stored.

4. Key in the sequence of keystrokes which you wrote down in step 1. Skip the keystrokes that enter data which would differ each time the program is used.

() 9. To run (or execute) a program:

1. Press [f] [P/R] to set the calculator back to run (calculator) mode.

2. Key in any required data.

3. Press [R/S] (run/stop) to begin program execution.

()10. Calculator programming is as simple as pressing the keys you would manually press to solve your problem. But even though the HP-12C calculator programming is simple to understand and use, it is a very powerful tool, giving you the capability to tackle complex problems with confidence.

Chapter 7 Summary

* A program is a sequence of keystrokes remembered by the calculator.
  Reference: Page 7-100, step 1.

* [f] [P/R] sets the calculator to program or run (calculator) mode.
  Reference: Page 7-100, step 4.

* [f] CLEAR [PRGM] clears program memory.
  Reference: Page 7-100, step 4.

* [R/S] runs (starts) and stops a program. Reference: Page 7-100, step 4.

Review Test for Chapter 7

The answers are on Page 7-106, immediately following this review test.

1. What is a program?

2. What are the 4 basic steps to create a program?

3. Which steps are necessary to run a program?

Answers to Review Test for Chapter 7

1. A program is a sequence of keystrokes that is remembered by the calculator. (Page 7-100, step 1)

2. To create a program:

   1. Write down the keystrokes to do the problem manually.
   2. Set program mode by pressing [f] [P/R].
   3. Press [f] CLEAR [PRGM] to clear the previous program.
   4. Key in the keystrokes from step 1.

   (Page 7-103, step 8)

3. To run a program:

   1. Press [f] [P/R] to set the calculator to run mode.
   2. Key in any required data.
   3. Press [R/S] to begin program execution.

   (Page 7-103, step 9)

NOTES

Programming Basics

Preview

In Chapter 8 you will:

* Identify instructions in program lines.
* Step through a program.
* Observe how program memory can be expanded.
* Go to any line of a program.

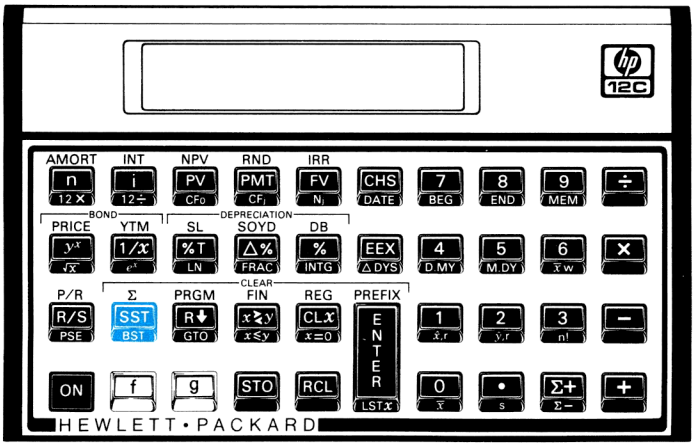
() 1. Let's turn our attention to the program from Chapter 7 to explain the information displayed in program mode. If it has been some time since Chapter 7 was studied, you should re-do steps 5-7 on pages 7-100 thru 7-102.

() 2. First put the calculator in program mode.

Keystrokes	Display
[f] [P/R]	00-

You are at the beginning of program memory. (Pressing [f][P/R] again will put you in run mode; [P/R] switches into and out of program mode.)

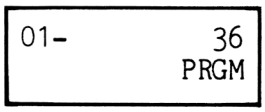
() 3. You will be using the [SST] (single step) key to display each step of the program.



Location of [SST]

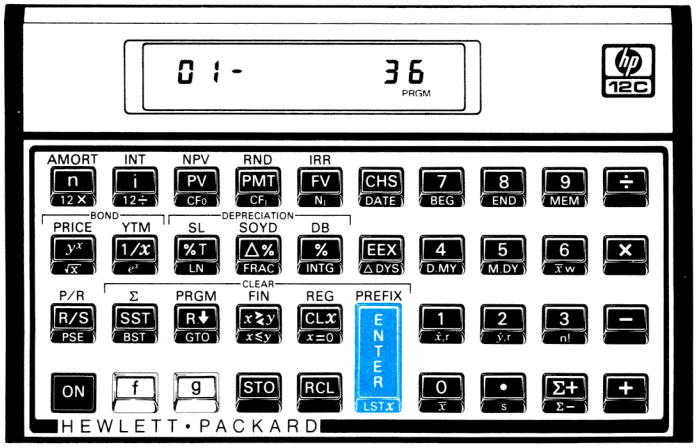
Figure 43

() 4. Press [SST] once. The display will change to:



() 5. The two digits displayed on the left designate the line number of program memory. Lines 01 through 99 are available for the program. The above display designates line 01.

() 6. The two digits displayed on the right designate the keycode of the instruction stored in that line. The first digit denotes the row of the key (numbered 1 to 4 from the top to the bottom) and the second digit the number of the key in that row (numbered 1, 2, ... , 9, 0 from left to right). So, 36 tells you that the key is in the third row on the calculator and that it is the sixth key from the left in that row, the [ENTER] key.



[ENTER] Has Keycode 36

Figure 44

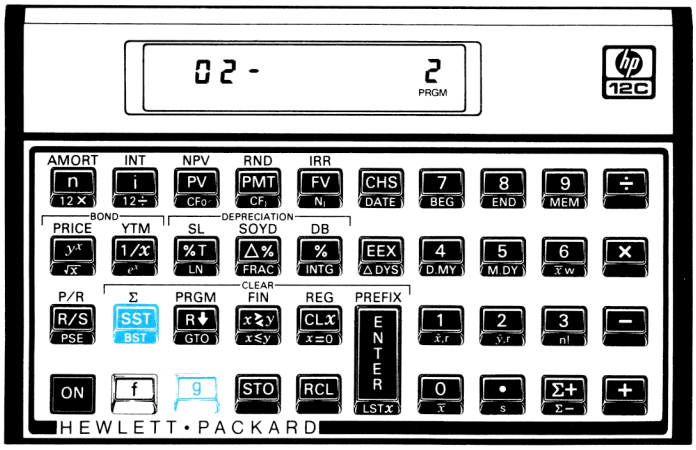
() 7. Each key on the keyboard has a two-digit keycode, except for the number (digit) keys. For convenience, the digit keys, and their respective shifted functions, are coded 0 through 9. All other keys are coded by their position on the keyboard.

() 8. Press [SST] once more. The display will show:

```
02-          2
          PRGM
```

The instruction in program line 02 is the digit 2.

() 9. The [BST] (back step) key steps back to display the contents of the previous line of program memory.



Location of [g][BST]

Figure 45

()10. Press [g][BST] and see:

```
01-          36
          PRGM
```

()11. Press [g][BST] again and see:

```
00-
          PRGM
```

()12. Pressing [SST] (single step) while the calculator is in program mode advances the calculator to the next line in program memory, then displays that line number and the keycode of the instruction stored there.

()13. Pressing [g][BST] (back step) while the calculator is in program mode sets the calculator back to the previous line in program memory, then displays that line number and the keycode of the instruction stored there.

()14. If either the [SST] or the [BST] key is held down, the calculator displays all of the lines in program memory. Press [SST], holding it down until program line 07 is displayed.

Keystrokes	Display		
[SST]	01-	36	Program line 01.
	.		
	.		
	.		
Release [SST]	07-	40	Program line 07.

Program line 07 contains the last instruction you keyed into program memory. However, if you press [SST] again, you will see that there is another line stored in program memory:

Keystrokes	Display		
[SST]	08- 43,33	00	Program line 08.

()15. The instruction in program line 08 is [g] [GTO] 00. This tells the calculator to "go to" program line 00. Although line 00 does not contain a regular instruction, it does contain a "hidden" instruction that tells the calculator to halt program execution.

()16. Thus, after the program is run, the calculator goes to program line 00 and halts, ready for you to key in new data and run the program again.

()17. When you press [f] [P/R] to set the calculator from program mode to run mode, the calculator is also automatically set to program line 00.

()18. If no instructions have been keyed into program memory, or if [f] CLEAR [PRGM] is pressed, the instruction [g] [GTO] 00 is automatically stored in program lines 01 through 08. As you key each instruction into program memory, it replaces the [g] [GTO] 00 instruction in that program line.

()19. When you clear the calculator of previous programs ([f] CLEAR [PRGM]), you have eight lines of program memory available and 20 data storage registers. The memory is allocated like this:

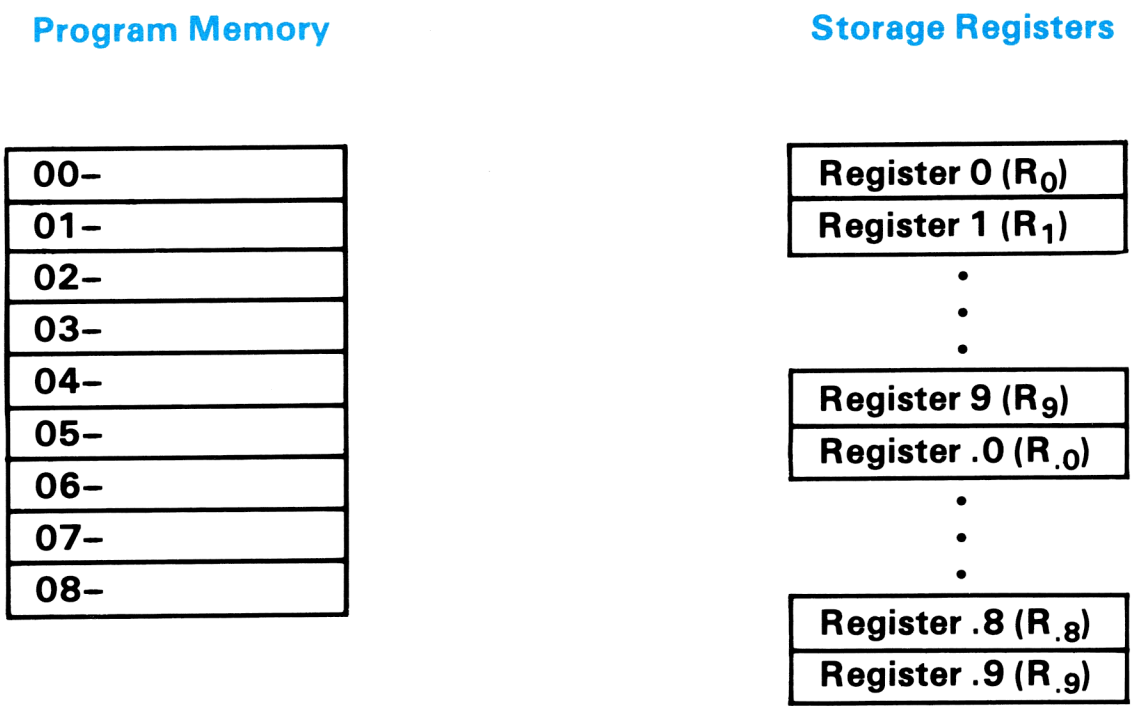


Figure 46

()20. As you key in the ninth program line, storage register R.9 (recall from Chapter 1 that R.9 is the last storage register) is converted to seven lines of program memory. The instruction you key in is stored in program line 09, and the instruction [g] [GTO] 00 is already stored in program lines 10 through 15. The memory allocation would then look like this:

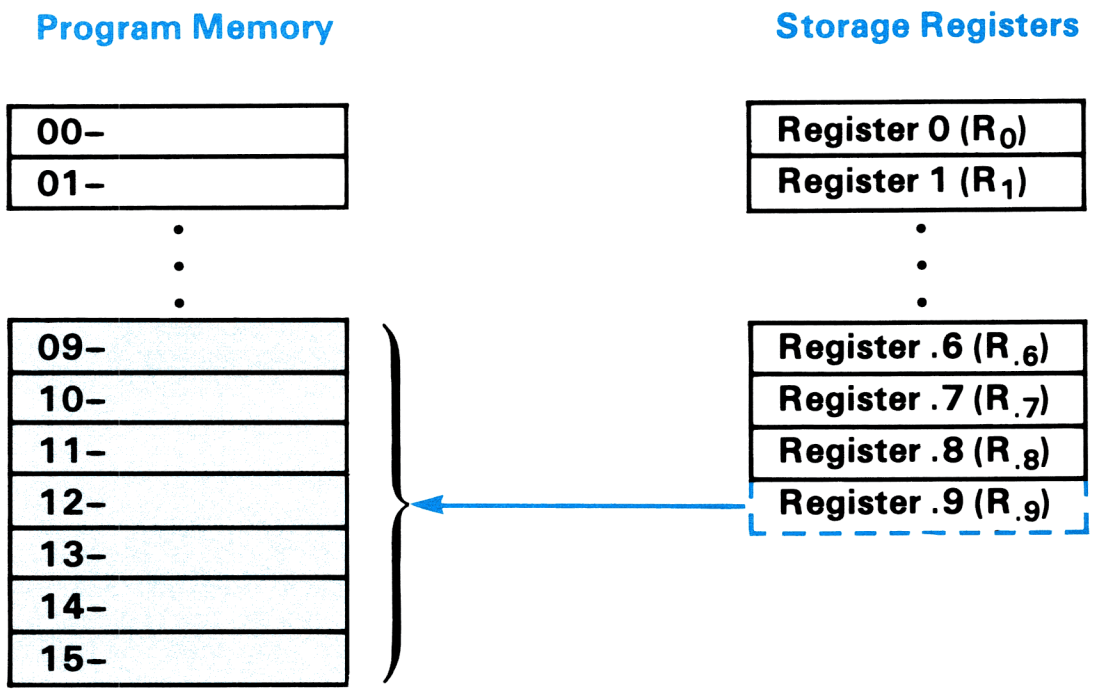
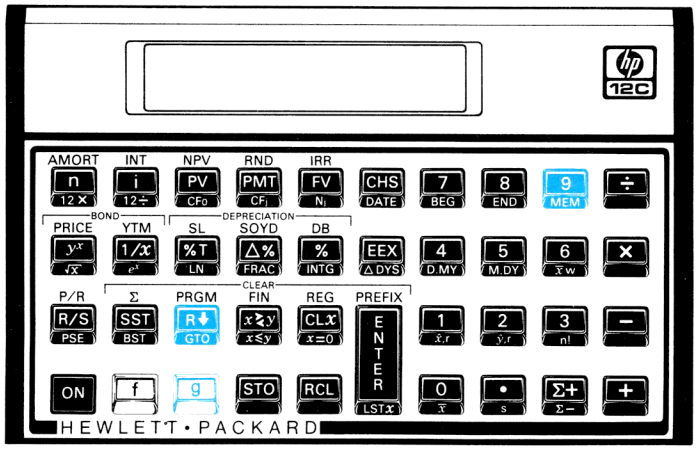


Figure 47

()21. Each time you use seven more lines of programming, the calculator automatically converts the bottom storage register into program memory.

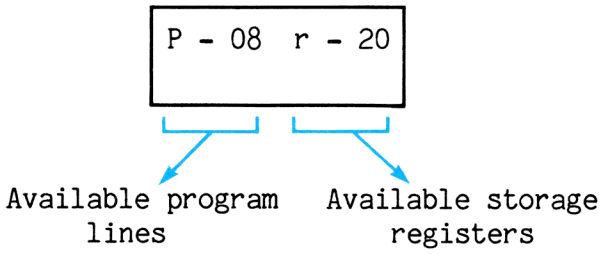
()22. The [MEM] (memory map) function describes the current memory allocation.



Locations of [g][MEM] and [g][GTO]

Figure 48

()23. To determine how many program lines (including those containing [g] [GTO] 00) are currently in program memory, and how many storage registers are currently available for conversion to program lines or for data storage, press [g] [MEM]. When you press [g] [MEM] after program memory has been cleared, the display will show:



()24. As long as you are pressing [MEM] the memory allocation will be displayed. When you let go of the [MEM] key, the calculator returns to the original display.

()25. The [MEM] function can be used at any time to see the number of lines available for programming and the number of registers available for storing data.

()26. Up to 99 instructions can be stored in program memory. Doing so would require the conversion of 13 data storage registers (because 99 = 8 + [13 x 7]), leaving 7 storage registers --- R0 through

R6 --- available for data storage.

()27. There may be occasions when you will want to set the calculator to a particular program line. Although [SST] can be used, as described previously, you can do so more quickly with the [GTO] (go to) key.

()28. For example, assuming that the calculator is still in program mode, you can set it to program line 04 as follows:

Keystrokes	Display		
[g] [GTO] [.] 04	04-	25	Program line 04.

()29. In program mode, pressing [g] [GTO] [.] followed by two digit keys sets the calculator to the program line specified by the digit keys. The display shows that line number and the keycode of the instruction stored there. (If the decimal point key is not used, the [GTO] instruction will be recorded in program memory.)

()30. In run mode, pressing [g] [GTO] (or [g][GTO][.]) followed by two digit keys sets the calculator to the program line specified by the digit keys. The line number and keycode are not displayed as the calculator is not in program mode, but pressing [f][P/R] does display the specified line number and keycode.

Chapter 8 Summary

* [SST] can be used (in program mode) to display a program one line at a time. Reference: Page 8-108, step 3.

* 99 lines of program memory are available. Reference: Page 8-109, step 5.

* [g][BST] is used (in program mode) to display the previous line of program memory. Reference: Page 8-110, step 9.

* [g][GTO] 00 is placed in each line of program memory when [f]CLEAR[PRGM] is pressed. Reference: Page 8-111, step 18.

* As more program memory is needed, one storage register is converted to seven lines of programming. Reference: Pages 8-113 - 8-114, steps 20-21.

* [g] [MEM] describes the current memory allocation.
Reference: Page 8-114, steps 22-25.

* [g] [GTO] can be used to set the calculator to any program line.
Reference: Page 8-115, steps 27-30.

Review Test for Chapter 8

The answers are on Page 8-118, immediately following this review test.

1. While keying in a program, the display looks like this:

```
00-
01-        36
02-         6
03-        25
04-        40
05-         2
06-        48
07-         5
08-        40
```

Which keys are being pressed?

2. How many program lines is each storage register equivalent to?

3. List 3 ways to set the calculator to a specific program line.

Answers to Review Test for Chapter 8

1.

Keystrokes	Display		Reference
[f] [P/R]	00-		(Page 8-109, step 6)
[f] CLEAR [PRGM]	00-	
[ENTER]	01-	36
6	02-	6
[%]	03-	25
[+]	04-	40
2	05-	2
.	06-	48
5	07-	5
[+]	08-	40

2. Each storage register is equivalent to 7 lines of program memory. (Pages 8-113 - 8-114, steps 20-21)

3. There are actually five ways to set the calculator to a specific program line:

   In program mode, press either
   a. [SST] as many times as necessary.
   or b. [g][BST] as many times as necessary.
   or c. [g][GTO][.] and the two digit keys representing the line number.

   In run mode, press either
   a. [g][GTO][.] , two digit keys, and [f][P/R].
   or b. [g][GTO], two digit keys, and [f][P/R].

   (Page 8-108, step 3, page 8-111, step 13, page 8-115, steps 27-30)

NOTES

Writing a Second Program

Preview

In Chapter 9 you will:

* Write and run a program that displays intermediate results.

() 1. Just as each of us writes in his own way, we each program in a unique style. While there are many correct ways to write a program, the solutions presented in this course show only one approach. The goal is to have a program do the job correctly --- how the program does it is of secondary importance.

() 2. To further explore the programming capabilities of your calculator, we will write a program to help you complete the amortization schedule for the first 4 months of a $55,000, 14%, 30 year mortgage:

Month Number	Payment	Interest	Principal	Remaining Balance
1	?	?	?	?
2	?	?	?	?
3	?	?	?	?
4	?	?	?	?

() 3. The information for the first month could be solved manually by pressing the following keys:

Keystrokes	Display	
[f] CLEAR [FIN]		The financial registers are cleared.
[g] [END]		END mode is set.
30 [g] [12x]	360.00	The total number of payments is stored.
14 [g] [12/]	1.17	The monthly interest rate is stored.
55000 [PV]	55,000.00	The loan amount is stored.

[PMT]	-651.68	The monthly payment amount is calculated.
0 [n]	0.00	The n-register is cleared.
1 [f] [AMORT]	-641.67	The interest portion of the payment is calculated.
[x<>y]	-10.01	The principal portion of the payment is displayed.
[RCL] [PV]	54,989.99	The remaining balance is displayed.

() 4. Now let's write a short program to replace the last three keystrokes listed above (1 [f][AMORT], [x<>y], [RCL][PV]). Before running this program, values for n, PV, and PMT will first be calculated or keyed in. Then the program will be run over and over again to calculate succeeding monthly values for interest, principal, and remaining balance. (Remember, after calculating the first month's interest payment using 1 [f][AMORT], the second month's interest is also calculated using 1 [f][AMORT].) Now enter the program by following these keystrokes:

Keystrokes	Display		
[f] [P/R]			Program mode is set.
[f] CLEAR [PRGM]	00-		Program memory is cleared.
1	01-	1	
[f] [AMORT]	02-	42 11	To calculate the interest portion.
[x<>y]	03-	34	To display the principal portion.
[RCL][PV]	04-	45 13	To display the remaining balance.

() 5. Notice that in two instances you recorded two keystrokes, [f][AMORT] and [RCL][PV], into one line of the program. Earlier, you saw that the four keystrokes in [g][GTO] 00 were also recorded in one line of programming.

() 6. [f][AMORT] and [RCL][PV], like [g][GTO] 00, have merged keycodes to conserve program memory. In every case where more than one key is required to perform a single operation ([g][12x], [g][END], [RCL] 1), the keycodes are merged into one line of program memory.

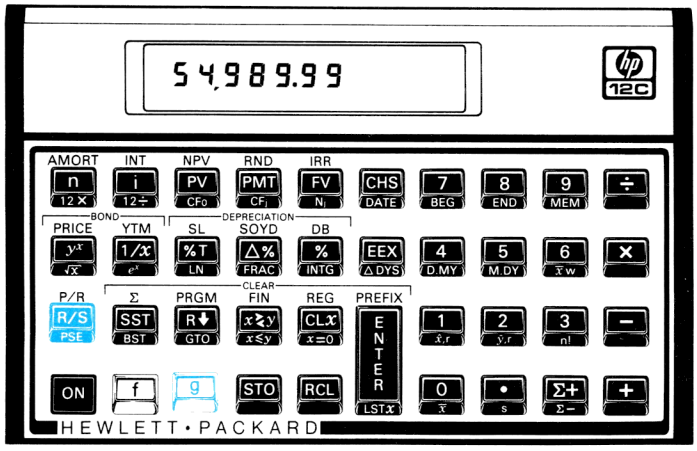
() 7. Each operation, prefixed or not, requires only one line of program memory.

() 8. To run the program you have just recorded, press the following keys:

Keystrokes	Display	
[f] [P/R]		Run mode is set.
[f] CLEAR [FIN]		The financial registers are cleared.
[g] [END]		The payment mode is set to END.
30 [g] [12x]	360.00	The total number of payments is stored.
14 [g] [12/]	1.17	The monthly interest rate is stored.
55000 [PV]	55,000.00	The loan amount is stored.
[PMT]	-651.68	The monthly payment amount is calculated.
0 [n]	0.00	The n-register is cleared.
[R/S]	54,989.99	The remaining balance is calculated. (What happened?)

() 9. The program didn't stop to show the amounts of interest and principal calculated. The calculator executed each program line sequentially until it reached the end of the program. Thus, only the final result is displayed.

()10. There are two operations on your HP-12C that will interrupt program execution when they are encountered as program instructions: [R/S] (run/stop) and [g][PSE] (pause).



Locations of [R/S] and [g] [PSE]

Figure 49

()11. [R/S] works differently as an executed program instruction than it does when pressed from the keyboard in run mode. As an executed instruction, [R/S] stops program execution, allowing you to key in new data or to write down an intermediate result.

()12. When [R/S] is pressed from the keyboard in run mode, the calculator resumes program execution sequentially downward.

()13. Now key in a new amortization program that will display the amount of interest and principal in each payment, as well as the remaining balance.

Keystrokes	Display		
[f] [P/R]			Program mode is set.
[f] CLEAR [PRGM]	00-		Program memory is cleared.
1	01-	1	
[f] [AMORT]	02-	42 11	To calculate the first month's interest.
[R/S]	03-	31	To display the interest.
[x<>y]	04-	34	To bring the principal to the display (the X-register).
[R/S]	05-	31	To display the principal.
[RCL][PV]	06-	45 13	To display the remaining balance.

()14. Use the program to complete the following amortization schedule for a $63,000 mortgage at 14.5% interest for 30 years.

Month Number	Payment	Interest	Principal	Remaining Balance
1	?	?	?	?
2	?	?	?	?
3	?	?	?	?
4	?	?	?	?

Keystrokes	Display	
[f] [P/R]		Run mode is set.
[f] CLEAR [FIN]		The financial registers are cleared.
63000 [PV]	63,000.00	The loan amount is stored.
30 [g][12x]	360.00	The total number of payments is stored.
14.5 [g][12/]	1.21	The monthly interest rate is stored.
[PMT]	-771.47	The monthly payment amount is calculated (and automatically stored into the PMT register).
0 [n]	0.00	The n-register is cleared.
[R/S]	-761.25	The first month's interest is displayed.
[R/S]	-10.22	The first month's principal is displayed.
[R/S]	62,989.78	The remaining balance after the first month is displayed.
[R/S]	-761.13	Second month's interest.
[R/S]	-10.34	Principal.
[R/S]	62,979.44	Remaining balance.
[R/S]	-761.00	Third month's interest.

[R/S]	-10.47	Principal.
[R/S]	62,968.97	Remaining balance.
[R/S]	-760.88	Fourth month's interest.
[R/S]	-10.59	Principal.
[R/S]	62,958.38	Remaining balance.

()15. In general, [R/S] is recorded into a program when you need to display more than one answer at the end of a program. [R/S] is not necessary when you want to display only one answer or the final answer of a series since the calculator automatically ends execution at line 00, ready to begin again.

()16. A [PSE] (pause) instruction executed in a program interrupts program execution for about 1 second. During the pause, the calculator displays the last result calculated before the [PSE] instruction.

()17. If the duration of the pause is not long enough to write down the number displayed, you can prolong the pause by using more than one [PSE] instruction. Alternatively, you can have the program stop by using [R/S] as described previously.

()18. To see how [PSE] can be used in a program, rewrite the amortization program to briefly display the interest and principal for each monthly payment.

Keystrokes	Display	
[f] [P/R]		
[f] CLEAR [PRGM]	00-	
1	01-	1
[f] [AMORT]	02-	42 11
[g] [PSE]	03-	43 31
[x<>y]	04-	34
[g] [PSE]	05-	43 31
[RCL] [PV]	06-	45 13

()19. Now return to run mode and execute the program using the example from step 14.

Keystrokes	Display	
[f] [P/R]		Run mode is set.
[f] CLEAR [FIN]		The financial registers are cleared.
63000 [PV]	63,000.00	The loan amount is stored.
14.5 [g][12/]	1.21	The monthly interest rate is calculated and stored.
30 [g] [12x]	360.00	The total number of payments is calculated and stored.
[PMT]	-771.47	The monthly payment is calculated and stored.
0 [n] [R/S]	-761.25	First month.
	-10.22	
	62,989.78	
[R/S]	-761.13	Second month.
	-10.34	
	62,979.44	
[R/S]	-761.00	Third month.
	-10.47	
	62,968.97	
[R/S]	-760.88	Fourth month.
	-10.59	
	62,958.38	

Chapter 9 Summary

* Each operation, prefixed or not, requires only one line of program memory. Reference: Pages 9-121 - 9-122, steps 6-7.

* In run mode, [R/S] starts and stops program execution.
Reference: Page 9-123, steps 11-12.

* [R/S] stops program execution when used as an instruction in a program.
Reference: Page 9-123, step 11.

* [g][PSE] executed as a program instruction interrupts program execution for about 1 second, displays the contents of the X-register, and then resumes program execution.
Reference: Page 9-125, step 16.

Review Test for Chapter 9

The answers are on Page 9-131, immediately following this review test.

1. While keying in a program, the display looks like this:

```
00-
01-     45  3
02-     45  2
03-         30
04-         20
05-         36
06-         36
07-     45  1
08-         30
09-         10
```

   Which keys are being pressed?

2. Write a program to calculate the total cost of any item assuming a 6.5% sales tax and a handling charge of $2.00. The cost including tax should be displayed briefly before the handling charge is added and displayed. The program should assume that the original cost of the item (without tax and handling charge) is in the display before execution. Using your program, complete the following table:

Original Cost	Cost + Tax	Cost + Tax + Handling Charge
45.00	----------	----------
112.15	----------	----------
98.37	----------	----------

3. An annual effective interest rate demonstrates the effect of compounding, for a full year of compounding periods, at a particular periodic interest rate. The periodic interest rate to be used is determined by dividing the stated nominal interest rate by the number of compounding periods per year. The effect is such that if the nominal rate is held constant, as the number of compounding periods per year is increased, the annual effective interest rate will increase.

   The following keystroke routine computes the effective annual interest rate given a nominal interest rate and the number of compounding periods per year.

   1. Press [f] CLEAR [FIN].

   2. Key in the nominal rate as a percentage and press [ENTER].

   3. Key in the number of compounding periods per year and press [n] [/] [i].

   4. Key in 100 and press [CHS] [ENTER] [PV] [FV].

   5. Press [+] to obtain the effective annual interest rate.

   Example: What is the effective annual interest rate if the annual nominal rate of 5 1/4% is compounded quarterly?

Keystrokes	Display	
[f] CLEAR [FIN]		The financial registers are cleared.
5.25 [ENTER]	5.25	The nominal interest rate is entered.
4 [n] [/] [i]	1.31	The quarterly interest rate is calculated and stored.
100 [CHS] [ENTER]	-100.00	
[PV] [FV]	105.35	An intermediate value is calculated.
[+]	5.35	The percent effective rate is calculated.

   Now write a program that computes the effective annual interest rate. The user would follow these instructions to execute the program:

   1. Press [f] CLEAR [PRGM].

   2. Key in the nominal rate as a percentage and press [ENTER].

3. Key in the number of compounding periods per year and press [R/S] to obtain the effective annual interest rate.

HINT: Compare these user instructions with the keystroke routine shown a few lines earlier. Notice that the user instructions include some of the keystrokes shown in the routine. The remaining keystrokes from the routine should appear in your program.

Next, test your program by using it to solve the above example (what effective rate corresponds to a nominal rate of 5.25% compounded quarterly?).

Keystrokes	Display

Answers to Review Test for Chapter 9

1.

Keystrokes	Display		Reference
[f] [P/R]	00-		(Pages 9-121 - 9-122, steps 5-7)
[f] CLEAR [PRGM]	00-		
[RCL] 3	01-	45 3	
[RCL] 2	02-	45 2	
[-]	03-	30	
[x]	04-	20	
[ENTER]	05-	36	
[ENTER]	06-	36	
[RCL] 1	07-	45 1	
[-]	08-	30	
[/]	09-	10	

2.

Keystrokes	Display		Reference
[f][P/R]	00-		(Page 9-125, steps 16-17)
[f] CLEAR [PRGM]	00-		
[ENTER]	01-	36	
6	02-	6	
.	03-	48	
5	04-	5	
[%]	05-	25	
[+]	06-	40	
[g][PSE]	07-	43 31	
2	08-	2	
[+]	09-	40	

3.

Keystrokes	Display		Reference
[f] [P/R]			(Pages 9-120 - 9-121, steps 3-4)
[f] CLEAR [PRGM]	00-		
[n]	01-	11	
[/]	02-	10	
[i]	03-	12	
1	04-	1	
0	05-	0	
0	06-	0	

[CHS]	07-	16
[ENTER]	08-	36
[PV]	09-	13
[FV]	10-	15
[+]	11-	40

[f] [P/R]

Example: What is the effective annual rate of interest if the annual nominal rate of 5 1/4% is compounded quarterly?

Keystrokes	Display	
[f] CLEAR [FIN]		
5.25 [ENTER]	5.25	
4 [R/S]	5.35	The percent effective rate is calculated.

NOTES

Editing a Program

Preview

In Chapter 10 you will:

* Execute a program one line at a time.

* Change a program.

* Key more than one program into program memory.

Finding the Error

() 1. Even the most experienced programmer finds errors in his programs. Whenever errors occur, they need to be found and corrected. Your HP-12C is designed to make this error-checking process as easy as possible.

() 2. One of the easiest ways to determine if your program is working properly is to work a test case in which you either know the answer or the answer can easily be determined.

() 3. For example, if you have a program that calculates the sum of several numbers and then finds the percent that each number is of the total sum, you can easily determine whether the program works. Just enter all like numbers (for example ten 10's) so that the percent total of each number is the same (10 is 10% of 100).

[SST] Execution

() 4. In longer programs, a wrong test-case answer will seldom pinpoint a mistake. For these cases, you can slow down program execution by using [SST] (single step) in run mode.

() 5. In run (calculator) mode, [SST] will execute your program one line at a time. When you hold the [SST] key down, in run mode, the program line number and keycode are displayed. When you release the [SST] key, the instruction is executed.

() 6. Use the following program to familiarize yourself with the [SST] operation.

Example: This program computes the total cost of a mail-order item when the sales tax is 6%.

Keystrokes	Display	
[f] [P/R]		
[f] CLEAR [PRGM]	00-	
[ENTER]	01-	36
6	02-	6
[%]	03-	25
[+]	04-	40
[f] [P/R]		

The program assumes that the cost of an item has been keyed into the display. Step through the program using a value of $200 for the cost of the item.

Keystrokes	Display		
200	200.		
[SST] (press and hold)	01-	36	The keycode for the first instruction, [ENTER], is displayed when [SST] is held down.
(release)	200.00		When [SST] is released, the [ENTER] instruction is executed.
[SST]	02-	6	The second instruction is displayed when [SST] is held down.
	6.		When [SST] is released, the second instruction is executed
[SST]	03-	25	The third instruction is displayed when [SST] is held down.
	12.00		When [SST] is released, the third instruction is executed.
[SST]	04-	40	The fourth instruction is displayed when [SST] is held down.

	212.00	When [SST] is released, the fourth instruction is executed.
[SST]	05- 43,33 00	The end of the program.
	212.00	The total price is calculated.

You can see that it would be easy to spot a mistake in your program using the [SST] key.

Changing One Program Instruction

() 7. Because of its built-in features, changing or correcting one line of a program is easy with your HP-12C. To change a single instruction in program memory:

1. Press [f] [P/R] to set the calculator to program mode.
2. Use [SST], [BST], or [GTO] [.] to set the calculator to the program line preceding the line containing the instruction to be changed.
3. Key in the new instruction.

() 8. For example, in the previous program, change the sales tax rate at line 02 to 7%.

Keystrokes	Display	
[f] [P/R]	00-	Program mode is set.
[SST]	01- 36	Line 01 is displayed.
7	02- 7	The new tax rate is keyed in.

The 6 previously stored in program line 02 is replaced by 7.

() 9. Now determine the total price to pay for a $100 item assuming a 7% sales tax.

Keystrokes	Display	
[f] [P/R]		
100	100.	The price is keyed in.
[R/S]	107.00	The total price is calculated.

Adding Instructions at the End of a Program

()10. To add one or more instructions at the end of the last program stored in program memory:

1. Press [f] [P/R] to set the calculator to program mode.

2. Press [g] [GTO] [.] followed by two digits that specify the last line you keyed into program memory (that is, the highest numbered line --- not necessarily the line most recently keyed in).

3. Key in the new instruction(s).

()11. In the previous program, add the necessary instructions to include a $3.50 handling charge on each order.

Keystrokes	Display	
[f] [P/R]	00-	
[g] [GTO] [.] 04	04-	40
3.5	05-	3
	06-	48
	07-	5
[+]	08-	40
[f] [P/R]		

()12. Determine the total price (including 7% tax and handling charge) of an item costing $100.

Keystrokes	Display	
100	100.	The price is keyed in.
[R/S]	110.50	The total cost is calculated.

Multiple Programs

()13. You can store more than one program in program memory, as long as you separate them with instructions which halt program execution after each program is run.

()14. To run the first program, which starts at line 01, press [R/S] in run mode if you have not run any previous programs. Otherwise, you will need to press [g] [GTO] 01 [R/S].

()15. To run programs recorded later in program memory, set the calculator to the first line of the program (using the [g] [GTO] instruction) before pressing [R/S].

()16. For example, assuming that program memory still contains the total cost program, store the amortization program from Chapter 9, step 13.

Keystrokes	Display		
[f] [P/R]	00-		Program mode is set.
[g] [GTO][.] 08	08-	40	The calculator is set to the last line keyed into program memory.
[g] [GTO] 00	09-	43,33 00	Ensures that the second program is separated from the first.
1	10-	1	
[f] [AMORT]	11-	42 11	The program is keyed in.
[R/S]	12-	31	
[x<>y]	13-	34	
[R/S]	14-	31	
[RCL] [PV]	15-	45 13	
[R/S]	16-	31	To display the remaining balance.
[g] [GTO] 10	17-	43,33 10	Go to line 10 for the next period.
[f] [P/R]			Run mode is set.

()17. With the two programs now stored in program memory, find the amount of interest and principal for the first month of a $45,000 mortgage at 16.75% interest with monthly payments of $638.10. What is the remaining balance after the first payment?

Keystrokes	Display	
[f] CLEAR [FIN]		The financial registers are cleared.
45000 [PV]	45,000.00	The mortgage amount is stored.
16.75 [g] [12/]	1.40	The monthly interest rate is stored.
638.10 [CHS] [PMT]	-638.10	The monthly payment amount is stored.
[g] [GTO] 10		Go to line 10 (the first line of the amortization program).
[R/S]	-628.12	The first month's interest is calculated.
[R/S]	-9.98	The first month's principal is displayed.
[R/S]	44,990.02	The remaining balance is displayed.

()18. To verify that the first program is still in program memory, determine the total cost of a jacket listed for $100.

Keystrokes	Display	
100	100.	The price is keyed in.
[g] [GTO] 01	100.00	Go to line 01 (the beginning of the program).
[R/S]	110.50	The total cost is calculated.

Chapter 10 Summary

* The easiest way to determine if your program is working correctly is to try a test case where the correct answer is known.
Reference: Page 10-134, step 2.

* [SST], in run mode, will execute a program one line at a time.
Reference: Page 10-134, step 5.

* To change one line of a program, set the calculator to the line preceding the line to be changed, and key in the new instruction.
Reference: Page 10-135, step 7.

* To add instructions at the end of a program, go to the last line of the program currently in program memory and key in the new instruction(s).
Reference: Page 10-137, step 10.

* It is possible to store more than one program in program memory.
Reference: Page 10-137, step 13.

* To run a second program stored in program memory, use [g] [GTO] to set the calculator to the first line of the program and press [R/S].
Reference: Page 10-138, step 15.

Review Test for Chapter 10

The answers are on Page 10-143, immediately following this review test.

1. Edit the amortization program currently in the calculator (see Page 10-138, step 16) to "pause" the remaining balance at the end of each period.

2. Now edit the amortization program to "pause" the period number of the next amortization schedule to be computed.

   HINT: When [f] [AMORT] is used to calculate the principal portion, interest portion, and remaining balance, for one or a series of payments, storage register n automatically contains the number of the last period amortized, assuming that 0 is stored in n before [f] [AMORT] is used.

3. Write a program which converts a temperature in degrees Fahrenheit to degrees Celsius. Then write a second program in program memory to convert degrees Celsius to degrees Fahrenheit. The following formulas should be used:

$$\frac{F - 32}{1.8} = C$$

$$F = (1.8 \times C) + 32$$

where F = degrees Fahrenheit
C = degrees Celsius

Hint: To convert degrees Fahrenheit to degrees Celsius, the following keystrokes would be used:

1. Key in the temperature in degrees Fahrenheit; press [ENTER].
2. Key in 32; press [-].
3. Key in 1.8; press [/]. The temperature in degrees Celsius is displayed.

Answers to Review Test for Chapter 10

1.

Keystrokes	Display	Reference
[f] [P/R]	00-	(Page 10-136, step 7)
[g] [GTO] [.] 15	15- 45 13	
[g] [PSE]	16 43 31	
[f] [P/R]		

2.

Keystrokes	Display	Reference
[f] [P/R]	00-	(Page 10-137, step 10)
[g] [GTO] [.] 16	16- 43 31	
[RCL] [n]	17- 45 11	
1	18- 1	
[+]	19- 40	
[g] [PSE]	20- 43 31	
[g] [GTO] 10	21- 43,33 10	
[f] [P/R]		

3.

Keystrokes	Display	Reference
[f] [P/R]		(Pages 10-137 - 10-139, steps 13-18)
[f] CLEAR [PRGM]	00-	
[ENTER]	01- 36	
3	02- 3	
2	03- 2	
[-]	04- 30	
1	05- 1	
[.]	06- 48	
8	07- 8	
[/]	08- 10	
[g] [GTO] 00	09- 43,33 00	
[ENTER]	10- 36	
1	11- 1	
[.]	12- 48	
8	13- 8	
[x]	14- 20	
3	15- 3	
2	16- 2	
[+]	17- 40	
[f] [P/R]		

To convert degrees Fahrenheit to degrees Celsius:

1. Key in the Fahrenheit degrees.
2. Press [R/S].

To convert degrees Celsius to degrees Fahrenheit:

1. Key in the Celsius degrees.
2. Press [g] [GTO] 10 [R/S].

NOTES

Chapter 11

Decisions

Preview

In Chapter 11 you will learn about:

* Branching.
* Looping.
* Conditional branching.

Branching

() 1. The instructions in a program are normally executed in the order of their program line numbers. However, in some situations it may be desirable to have program execution transfer or "branch" to a program line that is not in the next line of program memory.

() 2. The [GTO] (go to) instruction is used in a program to transfer execution to any program line.

() 3. When the [GTO] instruction is executed, program execution branches or "goes to" the program line specified and then continues sequentially.

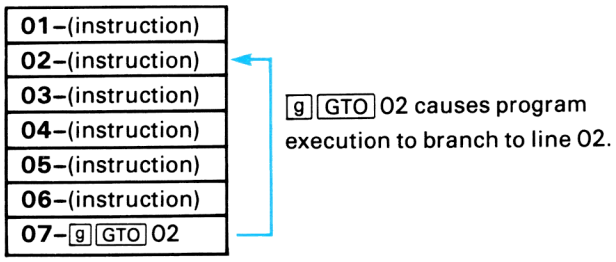


Figure 50

() 4. A [GTO] instruction used in this way is known as an unconditional branch. It always branches execution from the [GTO] instruction to the specified two-digit line number.

Looping

() 5. A common use of a branch is to create a "loop" in a program. Key in the following program which illustrates a counting loop.

Keystrokes	Display
[f] [P/R]	
[f] CLEAR [PRGM]	00-
[g] [PSE]	01- 43 31
1	02- 1
[+]	03- 40
[g] [GTO] 01	04- 43,33 01
[f] [P/R]	

() 6. To count from 1, press the following keys:

Keystrokes	Display
1 [R/S]	1.00
	2.00
	3.00
	4.00
	5.00
	6.00
	.
	.
	.
	etc.

The program will continue to count until you press [R/S].

() 7. Example: The following amortization program calculates the amount of interest and principal for each period, and continues to compute until you press [R/S] to stop program execution. Enter this program into your HP-12C.

Keystrokes	Display		
[f] [P/R]			Program mode is set.
[f] CLEAR [PRGM]	00-		Program memory is cleared.
0	01-	0	
[n]	02-	11	The n-register is cleared.
1	03-	1	
[f] [AMORT]	04-	42 11	The first month's interest is calculated.
[g] [PSE]	05-	43 31	The interest is displayed.
[x<>y]	06-	34	
[g] [PSE]	07-	43 31	The principal is displayed.
[RCL] [n]	08-	45 11	The number of periods amortized is recalled.
1	09-	1	
[+]	10-	40	The next period number is calculated.
[g] [PSE]	11-	43 31	The next period number is displayed.
[g] [GTO] 03	12-	43,33 03	Go to line 03 for the next calculation.
[f] [P/R]			Run mode is set.

() 8. Before running the program, the required data must be stored. Assume a $61,000 loan for 30 years at 14% interest (payments are made monthly).

Keystrokes	Display	
[g] [END]		END mode is set.
[f] CLEAR [FIN]		The financial registers are cleared.
61000 [PV]	61,000.00	The loan amount is stored.
30 [g] [12x]	360.00	The total number of payments

		is calculated and stored.
14 [g] [12/]	1.17	The monthly interest rate is calculated and stored.
[PMT]	-722.77	The monthly payment amount is calculated and stored.
[R/S]	-711.67	The first period's interest is displayed.
	-11.10	The first period's principal is displayed.
	2.00	Second year.
	-711.54	Second period interest.
	-11.23	Second period principal.
	3.00	Third year.
	-711.41	Third period interest.
	-11.36	Third period principal.
	4.00	Fourth year.
	-711.27	Fourth period interest.
	-11.50	Fourth period principal.
	.	
	.	
	.	
	etc.	

The program will continue until you press [R/S].

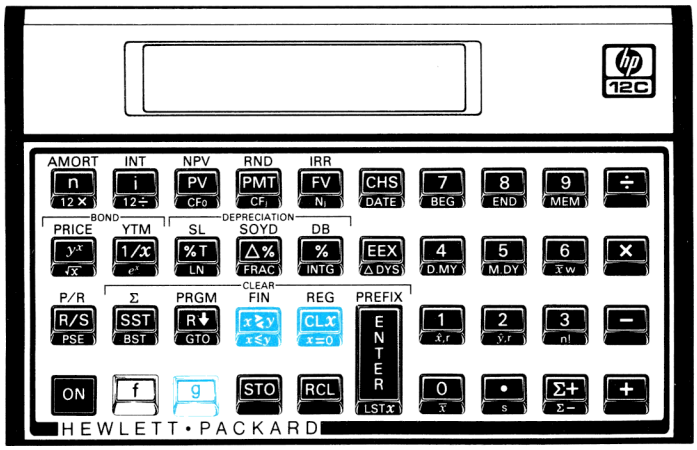
If you wish to write down the displayed values, you might want to change each [g] [PSE] program step to [R/S].

Conditional Branching

() 9. There are times when you want a program to make a decision based on certain conditions. For example, a program used by an accountant to calculate taxes might need to branch to different program lines depending on the tax rate for the particular income level.

()10. The HP-12C provides two instructions that are used in programs for

a branch that depends on the outcome of a test (a conditional branch): [X=0] (X equal to 0?) and [X≤Y] (X less than or equal to Y?).



Locations of [g][X≤Y] and [g][X=0]

Figure 51

()11. [X=0] tests whether the number in the display (the X-register) is equal to zero.

()12. [X≤Y] tests whether the number in the display (the X-register) is less than or equal to the number in the Y-register. The number in the Y-register is the number that would have been keyed in first in a two-number operation. For example, 4 [ENTER] 5 would place 4 in the Y-register and 5 in the X-register.

()13. When it is encountered in a program, each of the instructions essentially asks a question.

()14. If the answer is YES, program execution continues sequentially downward to the next instruction in program memory.

()15. If the answer is NO, the calculator branches around the next instruction.

()16. For example:

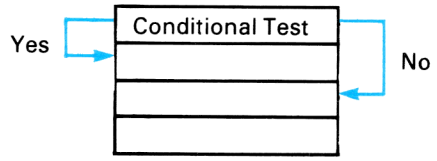


Figure 52

()17. After the conditional test, the calculator will do the next instruction if the test is true. This rule is easier to recall as the "DO if TRUE" rule.

()18. The line immediately following the conditional test can contain any instruction. A commonly used instruction is a [GTO] instruction. This branches program execution to another section of program memory if the conditional test is true, and continues with the next line in program memory if the condition is false.

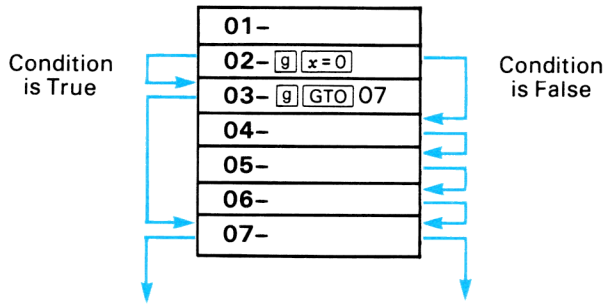


Figure 53

()19. Example: The following program counts backward from the number 5 and stops at zero by returning to the top of program memory.

Keystrokes	Display		
[f] [P/R]			Program mode is set.
[f] CLEAR [PRGM]	00-		Program memory is cleared.
5	01-	5	The number 5 is keyed in.
[g] [PSE]	02-	43 31	The number 5 is paused in the display.
1	03-	1	The number 1 is keyed in.
[-]	04-	30	The number 1 is subtracted from 5 --- you are counting

		backward.
[g] [X=0]	05- 43 35	Is the number equal to zero?
[g] [GTO] 00	06- 43,33 00	If zero has been reached, stop the program.
[g] [GTO] 02	07- 43,33 02	If zero has not been reached, go to line 02 and pause the next number in the display.
[f] [P/R]		Run mode is set.

To execute the program, press:

Keystrokes	Display
[R/S]	5.00
	4.00
	3.00
	2.00
	1.00
	0.00

()20. Example: This program calculates income tax at a rate of 20% on incomes of $20,000 or less and 25% on incomes of more than $20,000. To conserve program lines, the program assumes that the test value --- $20,000 --- is stored in register R0 and that the tax rates --- 20% and 25% --- are stored in registers R1 and R2 respectively.

NOTE: Before the program is run, the user keys into the display (the X-register) the income whose tax is to be calculated. The user does not press [ENTER]; [R/S] is pressed to start the program.

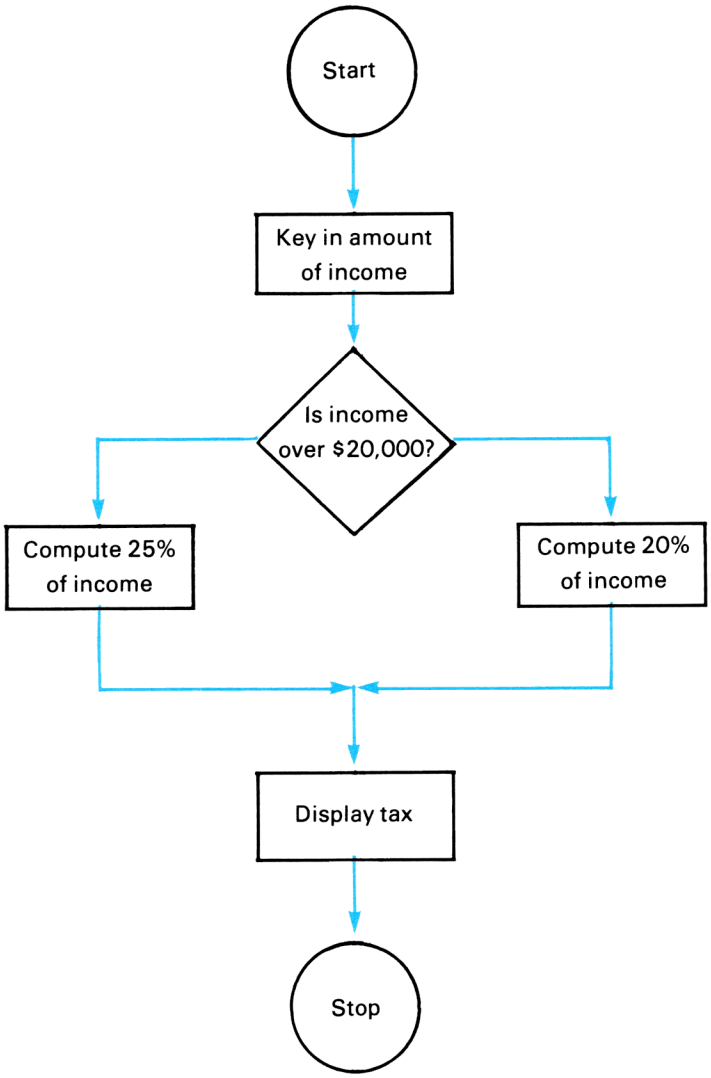
Keystrokes	Display	
[f] [P/R]		Program mode is set.
[f] CLEAR [PRGM]	00-	Program memory is cleared.
[RCL] 0	01- 45 0	The test value is recalled to the display (the X-register) and the income value, pre-

			viously in the X-register, is moved to the Y-register.
[x<>y]	02-	34	The test value is placed in the Y-register and the income is placed in the display (the X-register).
[g] [X≤Y]	03-	43 34	Is the income less than or equal to the test value ($20,000)?
[g] [GTO] 07	04-	43,33 07	Branch to line 07 if the condition is true.
[RCL] 2	05-	45 2	The 25% tax rate is recalled to the display.
[g] [GTO] 08	06-	43,33 08	Branches to program line 08.
[RCL] 1	07-	45 1	The 20% tax rate is recalled to the display.
[%]	08-	25	The tax is calculated.
[f] [P/R]			Run mode is set.

()21. Now, store the required numbers in registers R0, R1, and R2, and calculate the amount of tax on incomes of $16,000, $20,000, and $31,000.

Keystrokes	Display	
20000 [STO] 0	20,000.00	The test value is stored in register R0.
20 [STO] 1	20.00	The 20% tax rate is stored.
25 [STO] 2	25.00	The 25% tax rate is stored.
16000 [R/S]	3,200.00	20% of $16,000 = $3,200.
20000 [R/S]	4,000.00	20% of $20,000 = $4,000.
31000 [R/S]	7,750.00	25% of $31,000 = $7,750.

()22. Here is a pictorial representation of what the program is doing:



Flow Chart

Figure 54

Chapter 11 Summary

* [g][GTO] is used to branch program execution to a specified line number. Reference: Page 11-146, steps 2-4.

* A conditional branch is a branch to another program line which depends on the outcome of a test. Reference: Page 11-149, steps 9-10.

* [g][X=0] tests whether the display (X-register) is equal to zero. Reference: Page 11-150, step 11.

* [g][X≤Y] tests whether the X-register is less than or equal to the Y-register. Reference: Page 11-150, step 12.

* If the test is true, program execution continues to the next program line. Reference: Page 11-150, step 14, page 11-151, steps 16-17.

* If the test is false, the program skips the next program line and then continues execution. Reference: Pages 11-150 - 11-151, steps 15-16.

Review Test for Chapter 11

The answers are on Page 11-158, immediately following this review test.

1. What is a conditional branch?

2. What happens when a conditional test is encountered in a program?

3. Write a program that will allow a salesman to compute his commissions at the rate of 10% of sales to $2000, and 12.5% of sales over $2000.

   Calculate the commissions for sales of $625.00 and $2750.00.

   HINT: Use the following user instructions:

   1. Key in the amount of the sales.
   2. Press [R/S] to calculate the amount of the commission.

4. Write a program which calculates the sum of the first 15 integers. That is, what is 1 + 2 + 3 + . . . + 14 + 15? (Use a conditional test to determine when to stop summing numbers.)

   HINT:
   a. Store the value of the integer being added in R0.
   b. Store the current sum of the integers in R1.
   c. Your program should start by putting initial values in R0 and R1.

   User Instructions: Press [R/S] and see the sum of the first 15 integers in the display when the program stops.

Answers to Review Test for Chapter 11

1. A conditional branch is a branch to another program line which depends on the outcome of a test. (Page 11-149, step 10)

2. The tests X=0 and X≤Y ask a question when encountered in a program (is X equal to 0? and is X less than or equal to Y?). If the answer is YES, the program continues to the next program line. If the answer is NO, the calculator branches around the next program instruction. (Page 11-150, steps 11-15)

3.

Keystrokes	Display		Reference
[f] [P/R]			(Pages 11-150 - 11-151, steps 12-18)
[f] CLEAR [PRGM]	00-		
[ENTER]	01-	36	
2	02-	2	
0	03-	0	
0	04-	0	
0	05-	0	
[x<>y]	06-	34	
[g] [X≤Y]	07-	43 34	
[g] [GTO] 14	08-	43,33 14	
1	09-	1	
2	10-	2	
.	11-	48	
5	12-	5	
[g] [GTO] 16	13-	43,33 16	
1	14-	1	
0	15-	0	
[%]	16-	25	
[f] [P/R]			

Keystrokes	Display
625 [R/S]	62.50
2750 [R/S]	343.75

4.

Keystrokes	Display	Reference
[f] [P/R]		(Pages 11-150 - 11-151, steps 12-18)
[f] CLEAR [PRGM]	00-	
1	01- 1	
[STO] 0	02- 44 0	
[STO] 1	03- 44 1	
1	04- 1	
5	05- 5	
[RCL] 0	06- 45 0	
1	07- 1	
[+]	08- 40	
[STO] 0	09- 44 0	
[g] [X≤Y]	10- 43 34	
[g] [GTO] 13	11- 43,33 13	
[g] [GTO] 17	12- 43,33 17	
[RCL] 1	13- 45 1	
[+]	14- 40	
[STO] 1	15- 44 1	
[g] [GTO] 04	16- 43,33 04	
[RCL] 1	17- 45 1	
[f] [P/R]		

To run the program, press [R/S].

Keystrokes	Display	
[R/S]	120.00	The sum of the numbers 1 to 15 is calculated.

NOTES

Where Do I Go From Here?

You have finished the course. Congratulations!

You have learned a lot about the HP-12C, but there are a few more areas that you might wish to explore. The following topics can be found in the HP-12C Owner's Handbook and Problem-Solving Guide:

* Storage Register Arithmetic (Section 1).
* Odd Period Calculations (Section 3).
* Statistics Functions (Section 6).
* Mathematical Functions (Section 7).
* Adding Instructions Within a Program (Section 10).
* The Automatic Memory Stack (Appendix A).
* Error Conditions (Appendix C).

Another way to improve your calculator skills is to study keystroke procedures and programs written for specific applications. Sections 12-16 of the Owner's Handbook contains routines in the areas of Real Estate and Lending, Investment Analysis, Leasing, Savings, and Bonds. In addition, the HP-12C Solutions Handbook (00012-90009) provides a variety of applications in the financial area. (Check with your local Hewlett-Packard dealer for the availability of new HP-12C application books.) These books, along with the Training Guide, will serve as a reference to many of your problems and will show you how to redesign our examples to fit your specific needs.

NOTES

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The pages in parentheses denote chapter summaries.

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