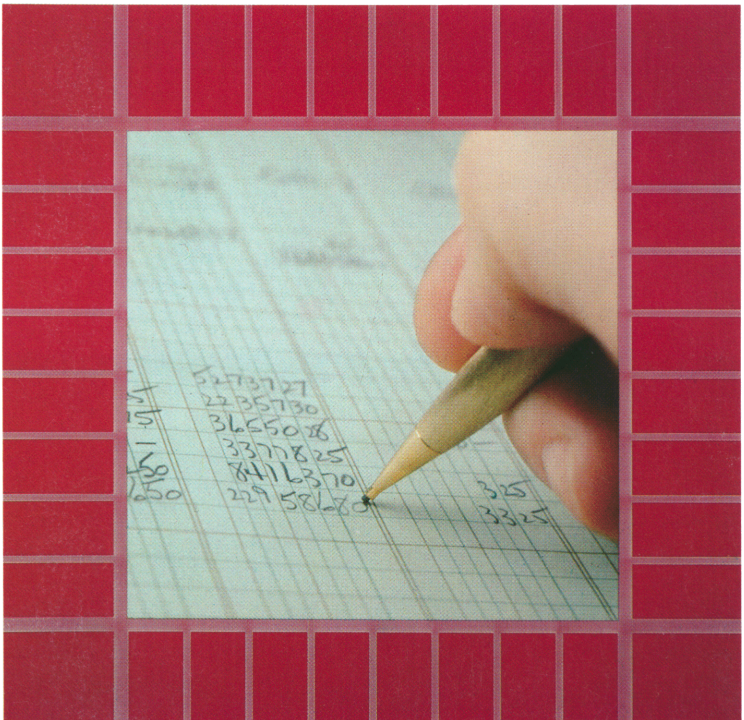
HEWLETT-PACKARD

HP-37E

OWNER'S HANDBOOK



"The success and prosperity of our company will be assured only if we offer our customers superior products that fill real needs and provide lasting value, and that are supported by a wide variety of useful services, both before and after sale."

Statement of Corporate Objectives.
Hewlett-Packard

When Messrs. Hewlett and Packard founded our company in 1939, we offered one superior product, an audio oscillator. Today, we offer over 3500 quality products, designed and built for some of the world's most discerning customers.

Since we introduced our first scientific calculator in 1967, we've sold millions worldwide, both pocket and desktop models. Their owners include Nobel laureates, astronauts, mountain climbers, businesspersons, doctors, students, and homemakers.

Each of our calculators is precision crafted and designed to solve the problems its owner can expect to encounter throughout a working lifetime.

HP calculators fill real needs. And they provide lasting value.

HEWLETT PACKARD

HP-37E
Owner's Handbook

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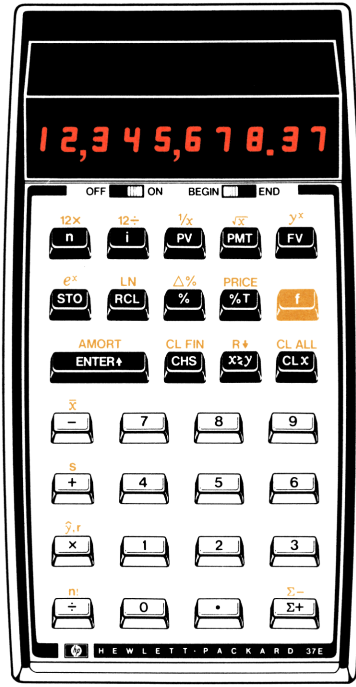


Financial Registers

n	i	PV	PMT	FV

Automatic Memory Stack

	T
	Z
	Y
	X

Storage Registers

R_0		
R_1		n
R_2		Σx
R_3		Σx^2
R_4		Σy
R_5		Σy^2
R_6		Σxy

The HP-37E Financial Calculator

Fold Out

Function Index

OFF ON
Power switch.

BEGIN END
Payment switch. Selects timing of payments in compound interest calculations **(page 16).**

f Shift key. Selects alternate function in gold above the function keys. Also used in display formatting **(page 7).**

Digit Entry

ENTER↑ Enters a copy of number in displayed X-register into Y-register. Used to separate numbers.*

CHS Changes sign of number or exponent of 10 in displayed X-register.*

0 thru 9 Digits. Used for keying in numbers and display formatting.*

• Decimal point. Also used for display formatting.*

CLX Clears contents of displayed X-register to zero.*

Reviewing Numbers

x≷y Exchanges contents of X- and Y-registers of stack.*

R↓ Rolls down contents of stack for viewing in displayed X-register.*

Manual Storage

STO Store. Followed by 0 through 6 or top row financial key stores displayed number in storage register specified. Also used to perform storage register arithmetic.*

RCL Recall. Followed by 0 through 6 or top row financial key recalls value from storage registers specified into the displayed X-register.*

CL ALL Clears contents of stack (X, Y, Z, T), all storage registers and financial registers.*

Arithmetic

+ − × ÷
Arithmetic operators **(page 8).***

Percentages

% Computes x% of y and retains the y value in the Y-register **(page 8).***

PRICE Computes selling price given markup based on selling price in Y-register and purchase cost in X-register **(page 10).**

Δ% Computes percent of change between number in Y-register and number in displayed X-register **(page 12).***

%T Computes percent that x is of number in Y-register **(page 13).***

Compound Interest

CL FIN Clears contents of financial registers **(page 16).**

n Stores or computes number of periods in financial problem **(page 19).**

12× Multiplies displayed X-register by 12 and stores the resulting value in the n-register **(page 18).**

* Refer to *Your HP Financial Calculator.*

[i] Stores or computes interest rate per compounding period **(page 22).**

[12÷] Divides displayed X-register by 12 and stores the resulting value in the i-register **(page 18).**

[PV] Stores or computes present value (initial cash flow) at the beginning of a financial problem **(page 24).**

[PMT] Stores or computes payment amount **(page 26).**

[FV] Stores or computes future value (final cash flow) at the end of a financial problem **(page 28).**

[AMORT] Amortizes x number of periods using values stored in [PMT], [i], [PV], and the display. Updates values in [PV] and [n] **(page 30).**

Mathematics

[$\sqrt{x}$] Computes square root of number in displayed X-register **(page 35).**

[y^x] Raises number in Y-register to power of number in displayed X-register **(page 36).**

[1/x] Computes reciprocal of number in displayed X-register **(page 35).**

[n!] Computes factorial $[n \cdot (n-1) \ldots 3 \cdot 2 \cdot 1]$ of number in displayed X-register **(page 39).**

[e^x] Natural antilogarithm. Raises e (approx. 2.718281828) to power of number in displayed X-register **(page 38).**

[LN] Computes natural logarithm (base e, approx. 2.718281828) of number in displayed X-register **(page 38).**

Statistics

[Σ+] Accumulates number from X- and Y-registers into statistical storage registers R_1 through R_6 **(page 41).**

[Σ−] Subtracts x and y values from statistical storage registers R_1 through R_6 for correcting [Σ+] accumulations **(page 42).**

[$\bar{x}$] Computes mean (average) of x and y values accumulated by [Σ+] **(page 42).**

[s] Computes sample standard deviations of x and y values accumulated by [Σ+] **(page 44).**

[$\hat{y}$,r] Linear estimate (X-register), correlation coefficient (Y-register). Fits a line to a set of x, y data points entered using [Σ+], then extrapolates this line to estimate a y value ($\hat{y}$) for a given x value. Also computes strength of linear relationship (r) among that set of x, y data points. **(page 45).**

Section 1

Using Your Calculator

If you are new to HP calculators and have not yet read *Your HP Financial Calculator: An Introduction to Financial Concepts and Problem Solving,* please do so now. We want you to feel comfortable with your HP-37E and we want to show you how easy it is to use.

The following section will briefly review arithmetic and retail calculations, as well as introduce some special features on your HP-37E. If you are already familiar with these functions, turn immediately to section 2 (page 15).

The Keyboard

Most keys on the HP-37E perform one or two functions. One function is indicated by the symbol on the key face, the second function is indicated by the gold symbol above the key.

- To select the function on the face of the key, press the key.
- To select the function printed in gold above the key, press the gold prefix key [f] then press the function key.

To execute the *clear all* function, press [f] [CL ALL].

To execute the *clear x* function, press [CLX].

In this handbook, the selected key function will appear in the appropriate color outlined by a box, like this: [CL ALL], [CLX].

Arithmetic Operators [+] [−] [×] [÷]

To perform an arithmetic operation:

1. Key in the first number.
2. Press [ENTER↑] to separate the first number from the second.
3. Key in the second number.
4. Press the proper key [+], [−], [×], or [÷] to perform the desired arithmetic operation.

Solve	Keystrokes	Display
10 ÷ 5	10 [ENTER↑] 5 [÷]	2.00
10 + 1 + 2 + 3	10 [ENTER↑] 1 [+]	
	2 [+] 3 [+]	16.00

Refer to *Your HP Financial Calculator* for further information concerning simple arithmetic, chain arithmetic, and the order of execution.

Retail Calculations

With the [%], [PRICE], [Δ%], and [%T] keys, you can easily compute a variety of retail calculations dealing with cost, markup, and selling price. (Refer to *Your HP Financial Calculator* for further explanation of percentage concepts.)

Percentage [%]

To find the percentage of a number, key in that base number and press [ENTER↑]. Then key in the numerical value of the percent and press [%].

Calculate	Keystrokes	Display
13% of 2,500	2500 [ENTER↑] 13 [%]	325.00

Notice that the keystroke sequence is similar to the keystrokes you learned for arithmetic operations. The function happens immediately when you press the [%] key.

Markup can be expressed as an *amount* or as a percentage *rate*. Either way, you need to know whether markup is *based* on *purchase cost* or *selling price*. Manufacturing firms normally use the original purchase cost of goods as the basis for calculating markup to maintain consistency in their accounting systems. For the same reason, most retail stores calculate markup on their selling prices since sales commissions, executive bonuses, and most accounting records and comparisons are based on selling prices.

Example: What is the markup on a used car that costs the dealer $2,500, if the dealer wants to obtain a markup of 35% based on cost?

Keystrokes	Display	
2500 [ENTER↑]	2,500.00	Enter the base number (cost).
35 [%]	875.00	Markup based on cost.

Since your calculator automatically holds the base number while you calculate percentages, you can find the selling price of the car by simply pressing [+].

Keystrokes	Display	
[+]	3,375.00	Selling price.

Given the selling price and the markup based on selling price, you can also calculate the original purchase cost of an item.

Example: Farina's Fabric House has an established line of designer fabric selling for $72.50 per yard. If Farina needs a 45% markup based on selling price, how much can she pay for the fabric?

Keystrokes	Display	
72.50 [ENTER↑]	72.50	Enter selling price.
45 [%]	32.63	Markup based on selling price.
[−]	39.88	Purchase cost per yard of fabric.

The PRICE Key

The most frequently encountered problem of a retail merchant is to establish a selling price when only the purchase cost and the percent markup to be maintained on the selling price are known. The problem is easily solved using PRICE.*

1. Key in the markup based on selling price.
2. Press ENTER↑.
3. Key in purchase cost.
4. Press f PRICE to compute the selling price.

Example: Harry's Bait and Tackle Shop can purchase crab pots for $5.60. If Harry desires to maintain a markup of 60% based on the selling price, how much is the selling price?

Keystrokes	Display	
60 ENTER↑	60.00	Enter markup then cost.
5.6 f PRICE	14.00	Selling price.

The markup is retained in the Y-register after PRICE calculations. To calculate the selling price of another item using the same markup, simply press CLx and key in the cost. For example, what is the price on a fishing rod that Harry can purchase for $38, based on the same markup?

Keystrokes	Display	
CLx	0.00	First clear the display.
38 f PRICE	95.00	Selling price.

What if you are given the markup based on cost and the selling price of an item, and want to compute the original purchase cost? You can still use the PRICE key. Simply change the sign of the markup percentage.

---

* The formula for PRICE is $\dfrac{x}{1 - \dfrac{y}{100}}$ where x is purchase cost and y is markup based on selling price.

Example: Marino's Yachts has earned the reputation of selling quality boats at good prices. Marino wants to add 19-foot and 21-foot boats to his stock but wants to keep the selling price down to $975 and $1,225. If he also wants to maintain a 30% markup based on the cost of the boat, how much can he pay for new boats?

Keystrokes	Display	
30 [CHS] [ENTER↑]	-30.00	Enter markup based on cost and change sign.
975 [f] [PRICE]	750.00	Purchase cost, 19-foot boat.
[CLx]	0.00	Clear the display.
1225 [f] [PRICE]	942.31	Purchase cost, 21-foot boat.

You may want to convert the percent of markup from a selling cost base to a purchase cost base or vice versa. You can do this with the [PRICE] key. Let's look at two examples.

Example: If an item is sold at a 30% markup based on selling price, what is the equivalent markup based on cost?

Keystrokes	Display	
30 [ENTER↑]	30.00	% markup based on selling price.
[f] [PRICE]	42.86	% markup based on purchase cost.

Example: If an item is sold at a 70% markup based on the purchase cost, what is the equivalent markup based on selling price?

Keystrokes	Display	
70 [CHS] [ENTER↑]	-70.00	Change sign of markup based on cost before and after [ENTER↑].
[CHS]	70.00	Now the Y- and X-registers have the correct values for the calculation.
[f] [PRICE]	41.18	% markup based on selling price.

Percent Difference Between Two Numbers [Δ%]

To find the percent difference between two numbers, i.e., the ratio of increase or decrease:

1. Key in the first number.
2. Press [ENTER↑] to separate the first number from the second.
3. Key in the second number.
4. Press [f] [Δ%].

Example: Your rent jumps from $285 a month to $335 a month. What percent is the increase?

Keystrokes	Display	
285 [ENTER↑]		
335 [f] [Δ%]	17.54	% increase.

Example: You forgot to place a stop order and your stock fell from $57.50 to $13.25 a share. What percent is the decrease?

Keystrokes	Display	
57.50 [ENTER↑]		
13.25 [f] [Δ%]	-76.96	% decrease.

When you calculate the **markup rate,** you find the percent difference between the selling price and the purchase cost. Remember that the first number entered is the base in percentage calculations.

Example: Burt Day's Cakeshop produced a 13,000 pound birthday cake for $6,630. If they sold the cake for $9,200, what percent of markup did they make on the cost?

Keystrokes	**Display**	
6630 [ENTER↑]	6,630.00	Enter cost (base) then key in selling price.
9200 [f] [Δ%]	38.76	% markup based on cost.

Example: What is the percent of markup, based on the selling price, for an item that costs $25.50 and carries a suggested manufacturer's retail price of $54?

Keystrokes	**Display**	
54 [ENTER↑]	54.00	Enter selling price (base) first.
25.5 [f] [Δ%] [CHS]	52.78	% markup based on selling price.

Percent of Total [%T]

To find what percentage one number is of a sum of numbers, first calculate the sum and then key in the particular number you wish to convert to a percentage and press [%T].

1. Key in the first number.
2. Press [ENTER↑].
3. Key in subsequent numbers (if any), each followed by [+].
4. Key in the particular number you wish to convert to a percentage of that total.
5. Press [%T].

Example: What percent is $5.50 of the sum of $10.25 + $5.50 + $3.25 + $21.00? And what percent is $21.00 of the same total?

Keystrokes	Display	
10.25 [ENTER↑]	10.25	Enter the first number.
5.50 [+] 3.25 [+]		
21 [+]	40.00	Key in and add the rest of the numbers.
5.50 [%T]	13.75	% of total.

The total is retained in the automatic memory stack—simply clear the display, key in a new number and find [%T].

Keystrokes	Display	
[CLx]	0.00	
21 [%T]	52.50	% of total.

Section 2

The Financial Functions

Your calculator has the most frequently used business calculations preprogrammed into the top row of keys. Note that some complex financial functions cause the display to blink on and off for several seconds, indicating that the calculation is being performed.

[n]	Number of periods.[1]
[i]	Interest rate per period.[1]
[PV]	Present value.[1]
[PMT]	Payment.[1]
[FV]	Future value.[1]
[12×]	Multiply by 12, store in n.
[12÷]	Divide by 12, store in i.
[AMORT]	Amortization.[2]

The Financial Registers

Special memories, called the financial storage registers, are reserved for compound interest calculations. To enter data into a financial register, simply key in the number and press the financial key. The financial keys either store or solve (see above).

Displaying Financial Values

Any of the values associated with the financial registers can be recalled by pressing [RCL] followed by the appropriate key (e.g., [RCL] [PV]).

[1] Solve and store function (has corresponding financial register).

[2] Solve-only function (no corresponding financial register). The [AMORT] function updates the values in the [n] and [PV] registers.

Clearing the Financial Registers

Each time you begin a new problem press [f] [CL FIN] to erase previous financial values. When you press [f] [CL FIN], the previous financial register values are replaced with zeros. The display remains unchanged. If you want to change some, but not all, of the values in a financial problem, it is not necessary to press [f] [CL FIN] and reenter all of the values again. Simply key in the new data and press the appropriate financial keys to change particular financial values.

Reentering Values

Once a value is stored in a particular register, it remains in the register for possible future use until it is either overwritten (replaced by another number) or the calculator is switched off.

There are three ways to overwrite (and consequently change) values stored in the financial registers.

1. Pressing [f] [CL ALL] or [f] [CL FIN].
2. Keying in a different number and pressing the original key. This stores the new value in the place of the original value.
3. Using the [AMORT] function. This function changes both the [n] and [PV] values.

The Payment Switch

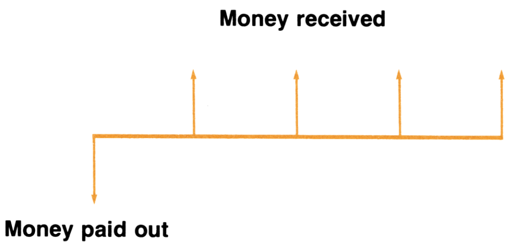
When doing compound interest calculations, the payment switch BEGIN END is used to differentiate between payments made at the beginning of each period (BEGIN) or at the end of each period (END). For a more thorough explanation, refer to *Your HP Financial Calculator*.

Financial Interest Calculations

The applications and examples here are representative of a wide range of possible calculations. If your specific problem is not included in the pages that follow, *don't* assume that your calculator won't solve it. Many problems in finance involve terminology that differs from industry to industry. The basic concepts are the same, but we all speak our own language, the vernacular of our profession.

The financial symbols n, i, PMT, PV, and FV, along with the concepts of simple and compound interest, amortization, and discounted cash flow analysis are explained in *Your HP Financial Calculator: An Introduction to Financial Concepts and Problem Solving*. We strongly encourage you to read the financial section of the book as it includes a discussion on how to solve virtually any compound interest problem with your calculator by using a cash flow diagram. A cash flow diagram enables you to describe a compound interest problem in terms that the calculator can understand. Once you draw and label your diagram, you simply key in the known data and solve for an unknown value.

If the solution to your problem isn't evident at first, construct a cash flow diagram—a picture of money received and money paid out.



Once you've done this, label your diagram with all of the known data that pertains to the problem: interest rate, duration of the transaction, number of compounding periods, payment amounts, amount of the loan or investment, etc. Instead of "What is my problem?" ask yourself, "What are the cash flows?"

Solving for any of the top row values (n, i, PV, PMT, or FV) is easy with your calculator. There are four simple rules to remember—rules that are the same for all compound interest calculations:

1. Given three or four of the financial values (n, i, PV, PMT, or FV), you can solve for the fourth and/or fifth values, as long as n and/or i are known.* Both n and i are involved in all financial calculations. You can enter the values in any order.

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* The calculator uses all four variables to solve for the fifth. Zero is assigned to those values that have not been computed or entered since the calculator was last cleared.

2. Use the cash flow sign convention throughout all compound interest calculations (including amortization): *Cash received (arrow pointing up) is represented by a positive value (+). Cash paid out (arrow pointing down) is represented by a negative value (−).*
3. Whenever payments (PMT) are involved, it is always necessary to specify whether the payments are made at the beginning of the payment period or whether the payments are made at the end of the payment period, by setting the payment switch BEGIN ▮▮▮ END to the proper position.
4. Remember that [n] and [i] must correspond to the same time frame. If n is months, then i must be the monthly interest rate; if n is the number of quarterly compounding periods, i must be the quarterly interest rate.

Remember, the n value represents the total number of compounding or payment periods. The alternate function, [f] [12×], converts yearly periods to monthly periods (12x) then automatically stores that number in [n]. To enter 30 years, press 30 [n]. If you wish to input that in monthly periods, press 30 [f] [12×]. The calculator converts 30 (years) to 360 (months) and stores it automatically in [n]. There is no need to press [n] again.

The i value is the interest rate per period. If interest is expressed as an annual rate compounding monthly, pressing [f] [12÷] calculates the interest rate per month and automatically stores it in [i]. To enter 9% annual interest press 9 [i]. To input the monthly rate, press 9 [f] [12÷]. There is no need to press [i] again, the monthly rate is automatically stored.

The [PMT] key stands for periodic payment* or deposit amount. It assumes equal periodic payments and must correspond to the same time frame as [n] or [i].

The [PV] key stands for present value;* the amount of money at the start of a transaction or the discounted amount of a future cash flow.

The [FV] key represents the future value* of money or the amount you will obtain/pay at the end of the term. Or you can use [FV] to solve for a balloon payment at the end of a transaction.

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* Remember the cash flow sign convention!

The following examples show some of the solutions for each of the financial values. (Refer to *Your HP Financial Calculator* for simple interest calculations.) If your problem does not match the example, draw a cash flow diagram, key in what you *do* know, using the conventions outlined above, and solve for the unknown value. You'll find that you can consider numerous investment alternatives with just a few easy keystrokes.

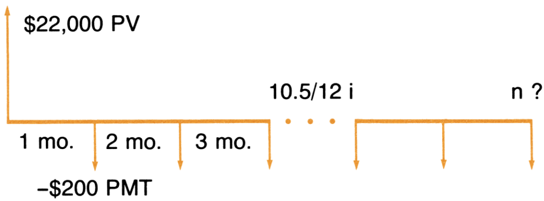
Compound Interest

Solving for the Number of Compounding or Payment Periods [n]

1. Set the payment switch, if applicable, to the desired setting and press [f] [CL FIN] which resets [n], [i], [PMT], [PV], and [FV] to zero.
2. Input the following in any order:
   - Key in the periodic interest rate, press [i].
   - Key in at least two of the following:
     - present value, press [PV],
     - payment amount, press [PMT], or
     - future value, press [FV].
3. Press [n] to obtain the number of periods.*

Example 1: Fur trapper Bill Buckskin wishes to invest in a $22,000 log cabin to keep the rain off. A local merchant has offered to loan Bill the $22,000 at 10.5% interest. Making $200 monthly payments, how long will it take Bill to repay his mortgage?

* If n is not an integer and PMT is not zero, then the use of the top row keys produce mathematically correct results with no simple useful interpretation. We show in the following examples, some instances in which the [n] value should be rounded up or down to an integer value, before other values are calculated. Refer to the applications books for bonds and notes applications with non-integer [n] values. If a value of [n] is calculated such that 0.995 ≤ n ≤ 1, we assume that it was done unintentionally. Therefore, the [n] value will automatically be rounded to 1, before other top row values are calculated.



Set the payment switch BEGIN END to END.

Keystrokes	Display	
f CL FIN		
10.5 f 12÷	0.88	% monthly interest rate.
200 CHS PMT	–200.00	Negative for money paid out.
22000 PV	22,000.00	Loan amount (received).
n	376.89	Months.
12 ÷	31.41	Years.

We calculated 376.89 payment periods, but chances are, you wouldn't make the last payment separately on a fraction of a month. Let's calculate the fractional payment amount and add it to the regular payment to calculate, in essence, the balloon payment made in the 376th month.

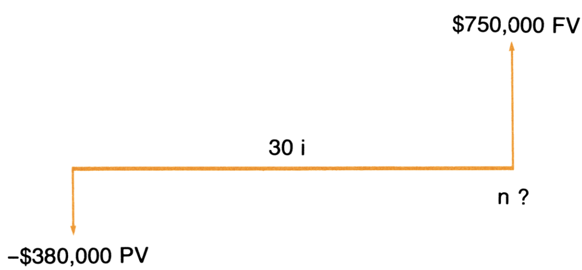
Keystrokes	Display	
376 n	376.00	Integer portion of number of periods.
FV	–175.88	Remaining balance after 376 payments.
RCL PMT	–200.00	Regular payment amount.
+	–375.88	Balloon payment.

What if, instead of a balloon payment, you wanted to make a final short payment? Round the calculated n to the next larger integer, then press FV to find the amount you should subtract from the payment amount.

(FV shows the amount that you would have overpaid, had you paid the full payment amount.)

Keystrokes	Display	
377 n	377.00	n rounded up to whole number.
FV	22.58	Amount to be subtracted from payment.
RCL PMT	–200.00	Payment amount.
+	–177.42	Final short payment.

Example 2: A potential oil field site currently appraised at $380,000 appreciates at 30% per year. If this rate continues, how many years will it be before this land is worth $750,000?

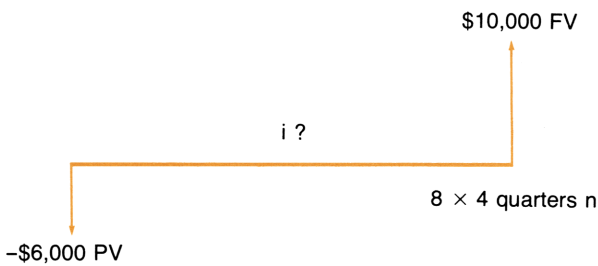


Keystrokes	Display	
f CL FIN		Clear financial registers.
30 i	30.00	
380000 CHS PV	–380,000.00	Remember the sign convention.
750000 FV	750,000.00	
n	2.59	Years.

Solving for the Periodic Interest Rate [i]

1. Set the payment switch, if applicable, to the desired setting and press [f] [CL FIN].
2. Input the following in any order:
   - Key in the number of periods, press [n].
   - Key in at least two of the following:*
     - payment amount, press [PMT],
     - present value, press [PV], or
     - future value, press [FV].
3. Press [i] to obtain the periodic interest rate.
4. Key in the number of periods per year, press [×] to obtain an annual interest rate.

Example 1: What annual interest rate must be obtained to accumulate $10,000 in 8 years on an investment of $6,000, with quarterly compounding?



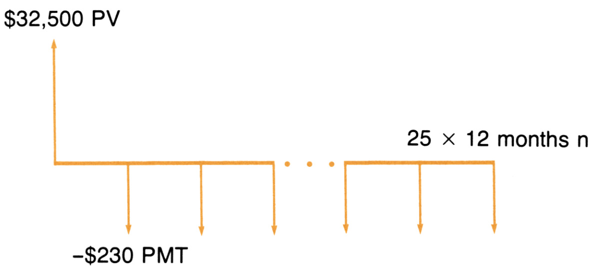
Keystrokes	Display	
[f] [CL FIN]		
8 [ENTER↑] 4 [×] [n]	32.00	Quarters.
6000 [CHS] [PV]	–6,000.00	Investment.
10000 [FV]	10,000.00	Total returned.
[i]	1.61	% quarterly interest rate.
4 [×]	6.44	% annual interest rate.

* Remember the sign convention!

What if the compounding were monthly?

Keystrokes	Display	
8 f 12×	96.00	Months.
i	0.53	% monthly interest rate.
12 ×	6.40	% annual interest rate.

Example 2: What is the annual interest rate on a 25-year, $32,500 mortgage with $230 monthly payments?



Set the payment switch BEGIN END to END.

Keystrokes	Display	
f CL FIN		
25 f 12×	300.00	Months.
230 CHS PMT	–230.00	Remember the sign convention.
32500 PV	32,500.00	Mortgage amount.
i	0.58	% monthly interest rate.
12 ×	7.01	% annual interest rate.

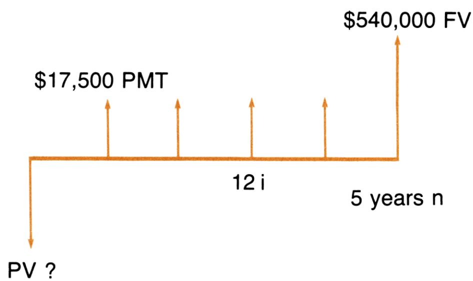
What is the annual interest if there is a balloon payment of $14,000 at the end of the 20th year?

Keystrokes	Display	
14000 CHS FV	14,000.00	Put balloon payment in FV.
20 f 12×	240.00	Change the value in n.
i	0.60	% monthly interest rate.
12 ×	7.21	% annual interest rate.

Solving for Present Value [PV]

1. Set the payment switch, if applicable, to the desired setting and press [f] [CL FIN].
2. Input the following in any order:
   - Key in the number of periods, press [n].
   - Key in the periodic interest rate, press [i].
   - Key in the payment amount and press [PMT] *or* the future value and press [FV] *or* both, if known.
3. Press [PV] to obtain the present value.

Example 1: A development company is purchasing a group of condominiums with an annual net cash flow of $17,500. The expected holding period is 5 years with an estimated selling price of $540,000 at that time. If the company wishes to realize a 12% yield, what is the maximum purchase price of the condominiums?

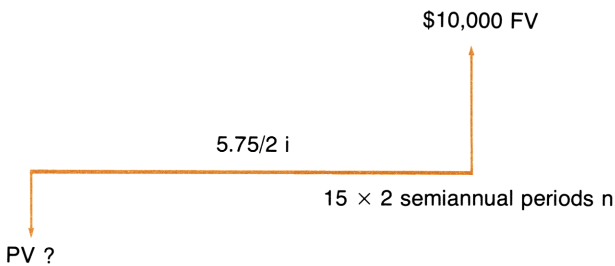


Set the payment switch BEGIN ▮▮▮ END to END.

Keystrokes	**Display**	
[f] [CL FIN]		
5 [n]	5.00	
12 [i]	12.00	
17500 [PMT]	17,500.00	
540000 [FV]	540,000.00	
[PV]	–369,494.09	Amount that company can pay to realize a 12% yield.

In this case [PV] represents the maximum price, $369,494.09 necessary to achieve the desired yield.

Example 2: You look forward to retirement in 15 years and wish to deposit one lump sum which will grow to $10,000 at that time, earning 5¾% interest compounded semiannually. How much do you need to deposit today to reach that goal?



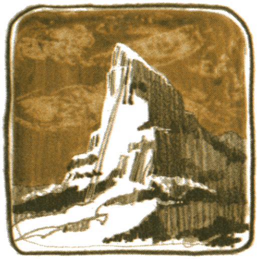
Keystrokes	Display	
f CL FIN		
15 ENTER↑ 2 × n	30.00	Semiannual periods.
5.75 ENTER↑ 2 ÷ i	2.88	% semiannual interest rate.
10000 FV	10,000.00	Amount needed.
PV	–4,272.72	Principal to be invested.

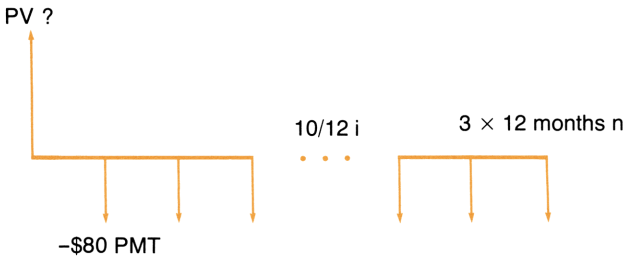
What if you also make semiannual deposits of $50?

Set the payment switch BEGIN END to END.

Keystrokes	Display	
50 CHS PMT	–50.00	Payment amount.
PV	–3,276.67	Principal to be invested.

Example 3: Rather than buying a dog sled, Yellowstone Sam decides to purchase a snowmobile. If he plans to pay $80 per month for 3 years, and if he's willing to pay 10% annual interest, how much can he afford to pay for the snowmobile?





Set the payment switch BEGIN ▮ END to END.

Keystrokes	Display	
f CL FIN		
3 f 12×	36.00	Months.
10 f 12÷	0.83	% monthly interest rate.
80 CHS PMT	−80.00	Monthly payment.
PV	2,479.30	Price he can afford for snowmobile.

Solving for the Periodic Payment Amount PMT

1. Set the payment switch to the desired setting and press f CL FIN.
2. Input the following in any order:
   - Key in the number of periods, press n.
   - Key in the periodic interest rate, press i.
   - Key in the present value and press PV *or* the future value and press FV *or* both, if known.
3. Press PMT to obtain the payment amount.

Example 1: Leaving the data from our last example in the calculator, what would Yellowstone Sam's monthly payments be if he finds a snowmobile for $2,150 and if the interest rate and duration of the transaction remain the same? Simply change the value in [PV].

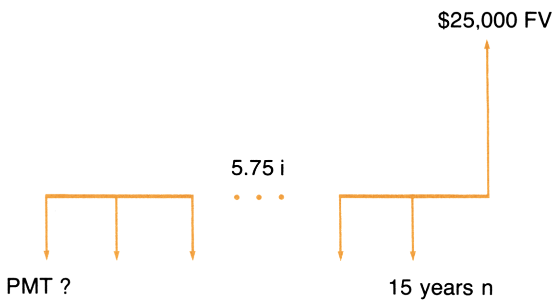
Keystrokes	Display	
2150 [PV]	2,150.00	
[PMT]	–69.37	Monthly payments.

Example 2: Find the monthly payment amount on a 20-year, $27,000 mortgage with an 8.5% annual interest rate.

Set the payment switch BEGIN END to END.

Keystrokes	Display	
[f] [CL FIN]		
20 [f] [12×]	240.00	Months.
8.5 [f] [12÷]	0.71	% monthly interest rate.
27000 [PV]	27,000.00	Loan amount.
[PMT]	–234.31	Monthly payment.

Example 3: Calculate the annual payment amount necessary to accumulate $25,000 in 15 years at 5¾% annual interest.



Set the payment switch BEGIN END to BEGIN.

Keystrokes	Display
[f] [CL FIN]	
15 [n]	15.00
5.75 [i]	5.75
25000 [FV]	25,000.00
[PMT]	–1,035.17

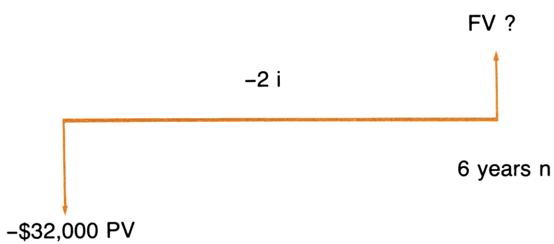
If your deposits are limited to $1,000 per year, how much will have accumulated over the same time period?

Keystrokes	Display
1000 [CHS] [PMT]	-1,000.00
[FV]	24,150.72

Solving for the Future Value [FV]

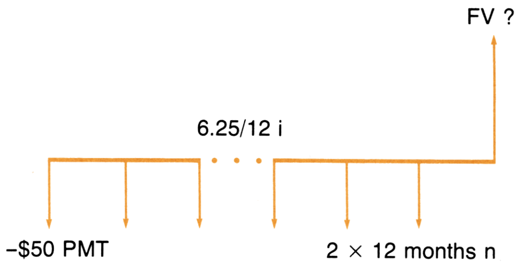
1. Set the payment switch, if applicable, to the desired setting and press [f] [CL FIN].
2. Input the following in any order:
   - Key in the number of periods, press [n].
   - Key in the periodic interest rate, press [i].
   - Key in the payment amount and press [PMT] *or* the present value and press [PV] *or* both, if known.
3. Press [FV] to obtain the future value.

Example 1: Property values in an unattractive area are declining at the rate of 2% per year. What will property presently valued at $32,000 be worth in 6 years if this trend continues?



Keystrokes	Display	
[f] [CL FIN]		
6 [n]	6.00	
2 [CHS] [i]	-2.00	% interest rate.
32000 [CHS] [PV]	-32,000.00	
[FV]	28,346.96	Property value.

Example 2: If you can afford to deposit $50 per month (beginning today) in an account with 6¼% interest compounded monthly, how much will you have 2 years from now?



Set the payment switch BEGIN END to BEGIN.

Keystrokes	Display	
[f] [CL FIN]		
2 [f] [12×]	24.00	Months.
6.25 [f] [12÷]	0.52	% monthly interest rate.
50 [CHS] [PMT]	–50.00	Monthly deposits.
[FV]	1,281.34	Savings.

If the interest rate remained the same, what monthly deposit amount would be necessary to have a savings of $1,500 in 2 years?

Keystrokes	Display	
1500 [FV]	1,500.00	
[PMT]	–58.53	Monthly deposit.

If you want to leave the deposit amount at $50 per month, how long would it take to accumulate $1,500?

Keystrokes	Display	
50 [CHS] [PMT]	–50.00	
[n]	27.81	Months.
12 [÷]	2.32	Years.

Amortization [AMORT]

You can use your calculator to compute the accumulated interest, principal portion of your payments, and remaining balance of your loan, at any point in time.

1. Press [f] [CL FIN].
2. Set the payment switch BEGIN END to the desired setting.

   Note: Use the cash flow sign convention; positive values for cash received and negative values for cash paid out.

3. Input the following in any order:
   - Key in the principal (amount of loan), press [PV].
   - Key in the periodic interest rate, press [i].
   - Key in the payment amount, press [PMT].
4. Key in the number of periods to be amortized, press [f] [AMORT] to find the accumulated interest on the loan.
5. Press [x⇄y] to obtain the portion of the payments made toward the principal, over the specified period of time.
6. Press [RCL] [PV] to obtain the remaining balance of the loan.
7. Press [RCL] [n] to obtain the total number of periods amortized.

In amortization, all payments to principal and payments to interest are rounded to match the display setting. If you compare your calculated answers to the statements of savings and lending institutions, the amount may differ by a few cents, due to different rounding techniques. The normal display shows numbers as dollars and cents. If your problem requires other rounding, set the display to the number of digits you wish carried. (Refer to *Your HP Financial Calculator,* The Display and Memory.)

Note: The [AMORT] function changes two of the top row values: [n] and [PV]. [PV] brings back the new balance, [n] provides the total number of periods amortized.

Example: Pianist Marcella Musica has finally decided to purchase the $14,000 grand piano of her dreams. If she takes out a loan at 10% interest per annum and wants to pay it off in 15 years, how much will her monthly payment be? After you calculate the monthly payment amount, reset [n] to zero and find the accumulated interest and principal portions of her payments and the remaining balance of her loan after 5 years.

Set the payment switch BEGIN ▮▮ END to END.

Keystrokes	Display	
[f] [CL FIN]		Clear financial registers.
14000 [PV]	14,000.00	Loan amount.
10 [f] [12÷]	0.83	Periodic interest rate.
15 [f] [12×]	180.00	Payment periods, 15 years times 12 months per year.
[PMT]	-150.44	Monthly payment.

Marcella's payments will be $150.44 each month. Now reset [n] and amortize.

Keystrokes	Display	
0 [n]	0.00	Set [n] to zero.
5 [ENTER↑] 12 [×]	60.00	Number of periods to be amortized in 5 years.
[f] [AMORT]	-6,411.13	Accumulated interest portions of payments made over 5 years.
[x≷y]	-2,615.27	Accumulated principal portions of payments made over 5 years.
[RCL] [PV]	11,384.73	Remaining balance.
[RCL] [n]	60.00	Number of periods amortized.

What portion of the payments made in the next 5 years or 60 compounding periods (years 6 through 10) pay off the accumulated interest, and what portion of these payments pay part of the principal? What is the remaining balance after 10 years?

Keystrokes	Display	
60 [f] [AMORT]	-4,723.41	Interest portion of payments made in year 6 through year 10.
[x⇄y]	-4,302.99	Principal portion of payments made in year 6 through year 10.
[RCL] [PV]	7,081.74	Remaining balance.
[RCL] [n]	120.00	Total number of periods amortized.

You can even generate a complete amortization schedule, one payment period at a time, by simply pressing 1 [f] [AMORT] for each period. If you start at the beginning of the schedule, be sure to change [PV] back to the original principal (as [PV] has been keeping a record of the remaining balance) and change [n] to zero. Generate the first 2 months of the schedule:

Keystrokes	Display	
14000 [PV] 0 [n]	0.00	
1 [f] [AMORT]	-116.67	Interest portion of first payment.
[x⇄y]	-33.77	Principal portion of first payment.
[RCL] [PV]	13,966.23	Remaining balance of loan.
1 [f] [AMORT]	-116.39	Interest portion of second payment.
[x⇄y]	-34.05	Principal portion of second payment.
[RCL] [PV]	13,932.18	Remaining balance of loan.

If you wish to calculate the remaining balance alone, simply use the [FV] key. Let's calculate the remaining balance of Marcella's loan, again after 10 years, to compare with our previous answer.

Keystrokes	Display	
14000 [PV]	14,000.00	Original principal.
120 [n]	120.00	10 years times 12 months.
[FV] [CHS]	7,081.70	Remaining balance.

Notice that the remaining balance calculated using [FV] is 4 cents less than the remaining balance calculated using [AMORT]. That's because [AMORT] causes each individual payment to be rounded, while [FV] does not cause numbers to be rounded internally.

Your HP-37E is capable of performing many important financial applications. Appendix B contains keystrokes for finding both the net present value (NPV) and the internal rate of return (IRR) of a series of cash flows. Refer to the applications books for more information concerning investment analysis.

Section 3

Mathematical Functions

Reciprocals [1/x]

When you multiply the reciprocal of a number times the number itself, you get one. For instance, the reciprocal of 2 is ½ or 0.5. Two times ½ equals one. To calculate the reciprocal of a number in the display, key in the number, then press [f] [1/x]. For this example, let's change the display to show all nine decimal places by pressing [f] 9.

Example: Add the reciprocal of 9 to the reciprocal of 11; $^1/_9 + ^1/_{11} = ?$

Keystrokes	Display	
[f] 9	0.000000000	Assumes no results remain from previous examples.
9 [f] [1/x]	0.111111111	Reciprocal of 9.
11 [f] [1/x]	0.090909091	Reciprocal of 11.
[+]	0.202020202	Sum of reciprocals.

Now find the reciprocal of the number in the display and then change the display back to show only two decimal places: now you are finding

$$\frac{1}{1/9 + 1/11}$$

Keystrokes	Display	
[f] [1/x]	4.950000000	Reciprocal of sum of reciprocals.
[f] 2	4.95	Back to original display format.

Square Root [√x]

To calculate the square root of a number, key in the number, then press [f] [√x].

Solve	Keystrokes	Display
$\sqrt{25}$	25 [f] [√x]	5.00
$\sqrt{81}$	81 [f] [√x]	9.00

You must use a positive number. You cannot calculate the square root of a negative number; that's an illegal operation.

You can also extract higher roots, like cube roots and fourth roots by using the [y^x] key, not the [$\sqrt{x}$] key.

Exponentiation: Raising a Number to a Power [y^x]

The [y^x] key raises a positive number to a positive or negative power or a negative number to an integer power. You use it the same simple way you've performed arithmetic operations; the function is executed immediately when you press the key.

1. Key in the base number. This number is designated as y.
2. Press [ENTER↑] to separate the first number from the second.
3. Key in the second number (power). This number is designated as x.
4. Press [f] [y^x].

In our last example we calculated $\sqrt{81} = 9$. Since we already have 9 in the display, simply press 2 [f] [y^x] to get back to 81.

Calculate 3^6:

Keystrokes	Display
3 [ENTER↑] 6	6.
[f] [y^x]	729.00

To raise a number to a negative power, follow the same procedure but press [CHS] to change the sign of your exponent before you perform the operation.

Solve $4.37^{-2.5}$:

Keystrokes	Display
4.37 [ENTER↑]	4.37
2.5 [CHS] [f] [y^x]	0.03

To raise a negative number to a positive or negative integer power, key in the base number, press [CHS], press [ENTER↑], key in the integer power, and press [f] [y^x].

Solve $(-2)^3$:

Keystrokes	**Display**
2 [CHS] [ENTER↑]	-2.00
3 [f] [y^x]	-8.00

With a negative base, if the exponent is an odd number, the answer will be negative. If the exponent is an even number, your answer will be positive:

$$(-2)^2 = -2 \times -2 = 4$$

$$(-2)^3 = -2 \times -2 \times -2 = -8$$

You can also use [y^x] to raise 0 to a positive power; but of course, your answer will always be zero.

The cube root of a number is that number raised to the $^1/_3$ power. Thus, $\sqrt[3]{n}$ is the same as $n^{1/3}$; the fourth root can be written as $n^{1/4}$ or $n^{0.25}$, etc.

Use the same keystroke sequence that you learned for exponentiation to extract higher roots:

1. Key in the base number and press [ENTER↑].
2. Key in the root desired, then press [f] [$1/x$]
3. Press [f] [y^x].

To solve $\sqrt[20]{10}$ $(10^{1/20})$:

Keystrokes	**Display**
10 [ENTER↑]	10.00
20 [f] [$1/x$] [f] [y^x]	1.12

Now, try $\sqrt[15]{22}$ $(22^{1/15})$:

Keystrokes	**Display**
22 [ENTER↑]	22.00
15 [f] [$1/x$] [f] [y^x]	1.23

Logarithms LN

To calculate the natural logarithm of a number, simply key in the number and press f LN. To find the $\log_e$ of 30:

Keystrokes	Display
30 f LN	3.40

Now, press f e^x. Because e^x is the antilog, you return to the original number, 30. To calculate the common logarithm (base 10) of a number, key in the number, then press f LN 10 f LN ÷.

To find $\log_{10}$ 5:

Keystrokes	Display
5 f LN	1.61
10 f LN	2.30
÷	0.70

Example: Logarithms are used in continuous compound interest formulas. If a savings institution offers a 7.79% effective rate on savings compounded continuously, what nominal rate does this represent?

$$\text{Nominal Rate} = 100 \times \ln\left(\frac{7.79}{100} + 1\right)$$

Keystrokes	Display	
7.79 ENTER↑	7.79	
100 ÷	0.08	
1 + f LN	0.08	
100 ×	7.50	Nominal percentage rate.

Antilogarithms e^x

To calculate the antilog of a number, key in the number and press f e^x. This raises e (2.718...) to the power of the value in the display:

Keystrokes	Display
30 f e^x	1.068647 13

Since you used the natural logarithm to convert continuous effective interest to the nominal rate, it follows that the antilog or e^x is used for the opposite conversion.

Example: To compute the continuous effective rate given the nominal rate, the formula is:

$$\text{Continuous Effective Rate} = \left(e^{\left(\frac{\text{Nominal Rate}}{100}\right)} - 1 \right) \times 100$$

So, if a savings institution quotes a nominal rate of 6%, compounded continuously, what is the effective rate?

Keystrokes	Display	
6 [ENTER↑]	6.00	
100 [÷]	0.06	
[f] [e^x] 1 [−]	0.06	
100 [×]	6.18	Continuous effective percentage rate.

Factorials [n!]

The n! *(factorial)* key permits you to handle permutations and combinations with ease. To calculate the factorial of a positive integer in the display, press [f] [n!].

Example: Calculate the number of ways that six people can line up for a photograph. Method: $P_6^6 = 6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1$.

Keystrokes	Display	
6	6.	
[f] [n!]	720.00	The answer.

The calculator overflows for factorials of numbers greater than 69.

Section 4

Statistical Functions

Summations

The [Σ+] key automatically accumulates several different sums and products of values in the X- and Y-registers. The calculator stores these values in registers R_1 through R_6.

When you key in one or two numbers and press [Σ+], the following happens:

1. One is added to the contents of register R_1. R_1 acts as a counter.
2. The number (x) in the display is added to the contents of storage register R_2.
3. The square (x^2) of the displayed number is added to the contents of register R_3.
4. The number (y) in the Y-register of the stack is added to the contents of storage register R_4.
5. The square of y (y^2) is added to the contents of register R_5.
6. The product of x and y (xy) is added to the contents of register R_6.

When you input paired data (x and y), you must key in the y-value first and separate the two numbers by [ENTER↑]. The general rule is:

y-value [ENTER↑] x-value [Σ+]

To recap, this is where values are stored inside your calculator:

Register	Contents
R_1	Number of entries (n).
R_2	Summation of x values (Σx).
R_3	Summation of x^2 values (Σx^2).
R_4	Summation of y values (Σy).
R_5	Summation of y^2 values (Σy^2).
R_6	Summation of products of x and y values ($\Sigma x y$).
Display (X-register)	Number of entries (n).

Immediately, you have a powerful data bank for statistical calculations.

> **Note:** If your data x_i or y_i contains many redundant leading digits, you should refrain from copying them into the calculator. For example, if your x-data is 999999999, 1000000001, 1000000002, you should enter the x-data as −1, 1, 2 and add the redundant digits (1000000000) to any x-related answer produced.

Viewing the Statistical Registers

To see any of the statistical accumulations at any time, simply press [RCL] then the address of the desired register (R_1 through R_6). Remember, when you recall a number from a register, only a copy of the number appears in the display.

Deleting and Correcting Data

If you key in an incorrect entry with [Σ+], you don't have to start over again. If you keyed it in before pressing [Σ+], simply press [CLx] to clear the display, then continue on with the correct value.

If you had already added in the wrong value, simply key in that wrong number and press [f] [Σ−], then continue with the correct number.

This applies to two variables, as well as one. Suppose you key in 10 [ENTER↑] 20 [Σ+] and discover that the y-value is wrong. Delete the data pair by pressing 10 [ENTER↑] 20 [f] [Σ−], then continue with the correct numbers.

Mean [$\bar{x}$]

Your calculator can quickly calculate the means or arithmetic averages of one or two variables. Whether it's the average of test scores or last month's sales figures, given one or two sets of numbers, your calculator will calculate the mean of those samples.

1. Press [f] [CL ALL]
2. If you are summing one set of numbers, key in the first number and press [Σ+]; then the second number and press [Σ+] again; the third number, etc. Continue until you have entered all the values.

3. If you are summing two sets of numbers, key in the y-value and press [ENTER↑]; key in the x-value, then press [Σ+]. Key in the second y-value, press [ENTER↑], key in the second x-value, and press [Σ+]. Continue until you have entered all the values.
4. Press [f] [x̄] for the mean of the x-values.
5. Press [x≷y] for the mean of the other set of values (y).

Example: A survey of seven salespersons in your company reveals that they work the following hours a week and sell the following dollar volumes each month. How many hours does the average salesperson work each week? How much does the average salesperson sell each month?

Salesperson	Hours/Week	Sales/Month
1	32	$17,000
2	40	$25,000
3	45	$26,000
4	40	$20,000
5	38	$21,000
6	50	$28,000
7	35	$15,000

To find the average workweek and sales of this sample:

Keystrokes	**Display**	
[f] [CL ALL]		Statistical registers cleared.
32 [ENTER↑]	*32.00*	
17000 [Σ+]	*1.00*	First entry.
40 [ENTER↑]	*40.00*	
25000 [Σ+]	*2.00*	Second entry.
45 [ENTER↑]	*45.00*	
26000 [Σ+]	*3.00*	
40 [ENTER↑]	*40.00*	
20000 [Σ+]	*4.00*	
38 [ENTER↑]	*38.00*	
21000 [Σ+]	*5.00*	

50 [ENTER↑]	50.00	
28000 [Σ+]	6.00	
35 [ENTER↑]	35.00	
15000 [Σ+]	7.00	Total number of entries in the sample.
[f] [x̄]	21,714.29	Mean dollar sales per month (x).
[x⇄y]	40.00	Mean workweek in hours (y).

Standard Deviation [s]

The [s] function calculates the standard deviation (a measure of dispersion around the mean) of the accumulated data. With the data intact from the previous example, compute [s] as follows:

Keystrokes	Display	
[f] [s]	4,820.59	Dollars (s_x).
[x⇄y]	6.03	Hours (s_y).

Your calculator computes standard deviation according to the formulas:

$$s_x = \sqrt{\frac{n\,\Sigma x^2 - (\Sigma x)^2}{n\,(n-1)}} \qquad s_y = \sqrt{\frac{n\,\Sigma y^2 - (\Sigma y)^2}{n\,(n-1)}}$$

The formulas for s_x and s_y give *best estimates* of the population standard deviation based on a sample of the population. Thus, current statistical convention calls them *sample* standard deviations. So we have assumed that the seven salespersons are a sample of the population of *all salespersons,* and our formulas derive best estimates of the population from the sample.

What if the seven salespersons constituted the whole population of salespersons. Then we wouldn't need to *estimate* the *population* standard deviation. We can find the *true population* standard deviation (σ) when the data set equals the total population, using the following keystrokes. (It turns out that if you sum the mean of the population into the set itself and find the new s, computed using the formulas above, that s will be the *population* standard deviation, σ, of the original set.)

Keystrokes	Display	
f x̄	21,714.29	Mean (dollars).
Σ+	8.00	Number of entries + 1.
f s	4,463.00	σ_x.
x⇄y	5.58	σ_y.

To continue summing data pairs, press f x̄ f Σ- before entering more data.

Linear Regression

When you have a set of data points, it is often useful to find out how closely they are related to each other. If you find that the data points are closely related, they can help you make projections or estimates based on known data. Linear regression is a statistical method for defining a straight line that best fits a set of data points, thus providing a relationship between two variables.

Since two points define a line, at least two data points must be in the calculator before a line can be drawn or fitted to them. After you have accumulated the data points using the Σ+ key, you can quickly estimate other values. But these estimated values are not very reliable unless the original data can be described or generalized to a certain degree of accuracy.

Correlation Coefficient

It's a good idea to check the "goodness of fit" of the linear function, by calculating the correlation coefficient, before estimating other values. This will tell you how close to a straight line the data points lie.

Example: A commercial land appraiser has examined six vacant lots in the downtown section of a local community, all of which have the same depths but different frontages and values. Based on the following input data, what is the relationship between frontage and lot value? In other words, how well does the following data fit a straight line? Would this be a good sample for making estimates of y values?

(x) Lot Frontage (feet)	(y) Lot Value ($)
70.8	10,100
60.0	9,000
85.0	12,700
75.2	11,120
69.5	11,000
84.0	12,500

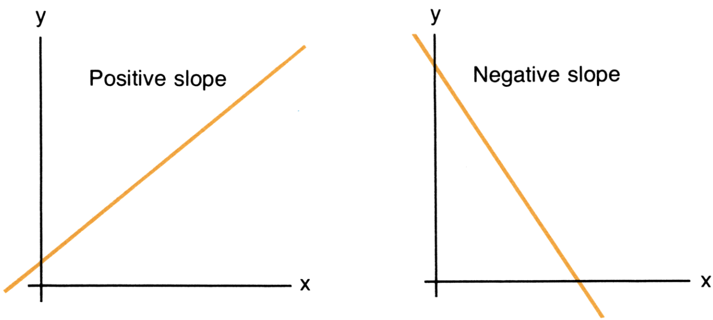
Accumulate the data using [Σ+]. Remember that when you enter two values, x and y, you must enter the y-value first.

Keystrokes	Display	
[f] [CL ALL]		
10100 [ENTER↑]	10,100.00	First entry.
70.8 [Σ+]	1.00	
9000 [ENTER↑]	9,000.00	Second entry.
60 [Σ+]	2.00	
12700 [ENTER↑]	12,700.00	Third entry.
85 [Σ+]	3.00	
11120 [ENTER↑]	11,120.00	Fourth entry.
75.2 [Σ+]	4.00	
11000 [ENTER↑]	11,000.00	Fifth entry.
69.5 [Σ+]	5.00	
12500 [ENTER↑]	12,500.00	Sixth entry.
84 [Σ+]	6.00	

Now that the data is stored, you can find the correlation coefficient by pressing [ŷ,r] and then [x⇄y].

Keystrokes	Display	
[f] [ŷ,r] [x⇄y]	0.97	Correlation coefficient r.

The correlation coefficient, r, is always a value between −1 and +1. If r = +1, then the line has a positive (upward) slope and the data fits perfectly. If $r = -1$, the data still is a perfect fit but the line has a negative (downward) slope.



An example of a negative trend is declining property values or declining sales. If $r = 0$, the data values are spread out and do not come close to a straight line. It would be useless to find linear estimates from unrelated data.

In the example of lot frontage related to value, the correlation coefficient is close to 1, so we can feel comfortable using linear regression.

Suppose, though, that the correlation coefficient was not close to 1 but instead was 0.5 or 0.6. This would indicate that a straight line is not a very good fit to the data. Then you might try to fit a curve to the data.

Refer to the applications books for a description of three other types of curves: exponential, logarithmic, and power. A correlation coefficient can be calculated for each of these curves and should be interpreted similarly: if r is close to ± 1, the curve is a reasonable approximation of the data. If not, try a different curve.

Linear Estimates

Now that we know our data fits a line closely, we can trust results of our linear estimates. With the data totalled in registers R_1 through R_6, a predicted y (designated $\hat{y}$) can be calculated by keying in an x value and pressing [$\hat{y},r$].

Example 1: For the previous example, find projected values for 80-, 95-, and 100-foot frontages.

Keystrokes	Display	
80 [f] [ŷ,r]	11,922.65	80-foot frontage projected value.
95 [f] [ŷ,r]	14,084.29	95-foot frontage projected value.
100 [f] [ŷ,r]	14,804.83	100-foot frontage projected value.

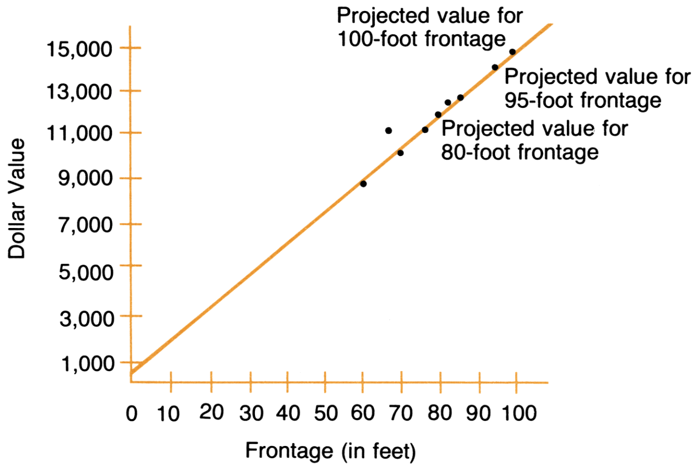
If you wish to graph the regression line, you can calculate the coefficients of the linear equation y = A + Bx as follows:

Keystrokes	Display	
0 [f] [ŷ,r]	393.90	y-intercept (A); projected value for x = 0.
[STO] 0	393.90	Store this value for calculating the slope (B).
1 [f] [ŷ,r]	538.01	Projected value for x = 1. Now recall A and subtract it from this result to get B.
[RCL] 0 [−]	144.11	Slope of the line (B); indicates the change in the projected value caused by an incremental change in the x-value.

Thus the equation that describes the regression line is:

$$y = 393.90 + 144.11\,x$$

Plotting this example, you see that a 1-foot increase in the frontage results in a projected increase of $144.11 in value.



Example 2: You bought a house 3 years ago for $47,500. The first year it appreciated $5,000. The second year its value rose to $60,000. Today you figure the market price to be $64,000 if you were to sell. What will your house be worth next year?

Keystrokes	**Display**
f CL ALL	
47500 ENTER↑	47,500.00
1 Σ+	1.00
52500 ENTER↑	52,250.00
2 Σ+	2.00
60000 ENTER↑	60,000.00
3 Σ+	3.00
64000 ENTER↑	64,000.00
4 Σ+	4.00

To make a projection for next year (year 5), simply solve for ŷ:

Keystrokes	**Display**
5 f ŷ,r	70,250.00

Appendix A

Service and Maintenance

Your Hewlett-Packard Calculator

Your calculator is another example of the award-winning design, superior quality, and attention to detail in engineering and construction that have marked Hewlett-Packard electronic instruments for more than 30 years. Each Hewlett-Packard calculator is precision crafted by people who are dedicated to giving you the best possible product at any price.

After construction, every calculator is thoroughly inspected for electrical or mechanical flaws.

When you purchase a Hewlett-Packard calculator, you deal with a company that stands behind its products.

AC Line Operation

Your calculator contains a rechargeable battery pack consisting of nickel-cadmium batteries. When you receive your calculator, the battery pack inside may be discharged, but you can operate the calculator immediately by using the ac adapter/recharger.

> **Note:** Do not attempt to operate the calculator from the ac line with the battery pack removed.

The procedure for using the ac adapter/recharger is as follows:

1. You need *not* turn the calculator off.
2. Insert the ac adapter/recharger plug into the rear connector of the calculator.
3. Insert the power plug into a live ac power outlet.

CAUTION

The use of a charger other than the HP recharger supplied with the calculator may result in damage to your calculator.

Battery Operation

To operate the calculator from battery power alone, simply disconnect the recharger plug from the rear of the calculator. (Even when not connected to the calculator, the ac adapter/recharger may be left plugged into the ac outlet.)

Using the calculator on battery power gives the calculator full portability, allowing you to carry it nearly anywhere. A fully charged battery pack typically provides 3 hours of continuous operation. By turning the power off when the calculator is not in use, the charge on the battery pack should easily last throughout a normal working day.

Low Power

When you are operating from battery power and the batteries get low, a raised decimal is turned on at the far left of the display to warn you that you have between 1 minute and 25 minutes of operating time left.

˙1.23

If the display contains the low power indication, the minus sign looks like an incomplete divide sign.

∸1.23

To return to full power either connect the ac adapter/recharger to the calculator as described under AC Line Operation, or substitute a fully charged battery pack for the one in the calculator.

Note: The ac adapter/recharger is a sealed unit and is not repairable. Return it to Hewlett-Packard if service is required.

Battery Charging

The rechargeable batteries in the battery pack are charged while you operate the calculator from the ac adapter/recharger. Batteries will charge with the calculator on or off, provided batteries are in place and recharger is connected. Normal charging times between the fully discharged state and the fully charged state are (depending on ac line voltage value):

Calculator off:	5 to 9 hours
Calculator on:	17 hours

Shorter charging periods will reduce the operating time you can expect from a single battery charge. Whether the calculator is off or on, the calculator battery pack is never in danger of becoming overcharged.

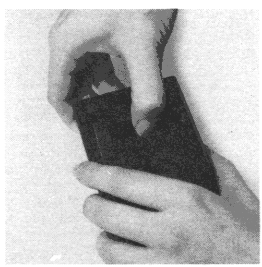
Note: It is normal for the ac adapter/recharger to be warm to the touch when it is plugged into an ac outlet.

Battery Pack Replacement

To replace the battery pack use the following procedure:

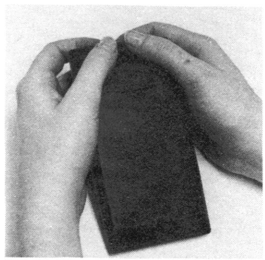
1. Set calculator ON-OFF switch to OFF and disconnect the battery ac adapter/recharger from the calculator.

2. Press down on the short ridges of the battery door, close to the edge, until the door release snaps open. Slide the door open.

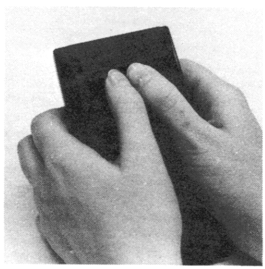


3. When door is removed, turn calculator over and gently shake, allowing the battery pack to fall into the palm of your hand.

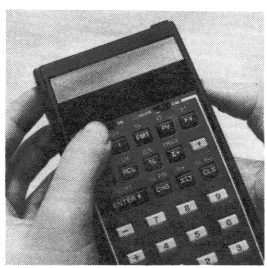
4. Place the new battery pack into the calculator. Your calculator will only turn on if the battery pack is inserted correctly.



5. Insert battery door and slide door back into place.



6. Turn calculator over and turn power on to assure proper battery installation. If the display does not light, make sure the battery pack is correctly placed in calculator.



Battery Care

When not being used, the batteries in your calculator have a self-discharge rate of approximately 1 percent of available charge per day. After 30 days, a battery pack might have only 50 to 75 percent of its charge remaining, and the calculator might not even turn on. If a calculator fails to turn on, you should substitute a charged battery pack, if available, for the one in the calculator or plug in the ac adapter/recharger. The discharged battery pack should be charged for at least 12 hours.

If a battery pack will not hold a charge and seems to discharge very quickly in use, it may be defective. If the one-year warranty on the battery pack has not expired, return the defective pack to Hewlett-Packard according to the shipping instructions. (If you are in doubt about the cause of the problem, return the complete calculator along with its battery pack and ac adapter/recharger.) If the battery pack is out of warranty, see your nearest dealer to order a replacement.

WARNING

Do not attempt to incinerate or mutilate the battery pack—the pack may burst or release toxic materials.

Do not connect together or otherwise short-circuit the battery terminals—the pack may melt or cause serious burns.

Temperature Range

Temperature ranges for the calculator are:

Operating	0° to 45°C	32° to 113°F
Charging	15° to 40°C	59° to 104°F
Storage	–40° to 55°C	–40° to 131°F

Service

Blank Display

If the display blanks out, turn the calculator off, then on. If a display of numbers does not appear in the display check the following:

1. If the ac adapter/recharger is attached to the calculator, make sure it is plugged into an ac outlet.

2. Examine the battery pack to see if the contacts are dirty.
3. Substitute a fully charged battery pack, if available, for the one that was in the calculator.
4. If the display is still blank, try operating the calculator using the ac adapter/recharger (with the batteries in the calculator).
5. If, after step 4, the display is still blank, service is required. (Refer to Limited One-Year Warranty.)

Repair Policy

Hewlett-Packard calculators are normally repaired and reshipped within five (5) working days of receipt at any repair center. This is an average time and could possibly vary depending upon time of year and work load at the repair center.

Shipping Instructions

The calculator should be returned, along with completed Service Card, in its shipping case (or other protective package) to avoid in-transit damage. Such damage is not covered by warranty and Hewlett-Packard suggests that the customer insure shipments to the repair center. A calculator returned for repair should include the ac adapter/recharger and the battery pack. Send these items to the address shown on the Service Card. *Remember to include a sales slip or other proof of purchase with your unit.*

Whether the unit is under warranty or not, it is your responsibility to pay shipping charges for delivery to the Hewlett-Packard repair center.

After warranty repairs are completed, the repair center returns the unit with postage prepaid. On out-of-warranty repairs, the unit is returned C.O.D. (covering shipping costs and the service charge).

Limited One-Year Warranty

What We Will Do

The HP-37E and its accessories are warranted by Hewlett-Packard against defects in materials and workmanship for one year from date of original purchase. If you sell your calculator or give it as a gift, the warranty is automatically transferred to the new owner and remains in effect for the original one-year period. During the warranty period we will repair or, at our option, replace at no charge a product that proves to be defective provided that you return the product, shipping prepaid, to a Hewlett-Packard repair center.

How to Obtain Repair Service

Hewlett-Packard maintains repair centers in most major countries throughout the world. You may have your calculator repaired at a Hewlett-Packard repair center anytime it needs service, whether the unit is under warranty or not. There is a charge for repairs after the one-year warranty period. Please refer to the Shipping Instructions in this handbook.

The Hewlett-Packard United States Repair Center for handheld and portable printing calculators is located at Corvallis, Oregon. The mailing address is:

HEWLETT-PACKARD COMPANY
CORVALLIS DIVISION SERVICE DEPT.
P.O. BOX 999
CORVALLIS, OREGON 97330

What Is Not Covered

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

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

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

Obligation to Make Changes

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

Warranty Information Toll-Free Number

If you have any questions concerning this warranty, please call 800/648-4711. (In Nevada call 800/992-5710.)

Technical Assistance

Should you need technical assistance concerning calculator applications, etc., call Hewlett-Packard Customer Support at 503/757-2000. This is not a toll-free number, and we regret that we cannot accept collect calls. As an alternative, you may write to:

Hewlett-Packard
Corvallis Division/Customer Support
1000 N.E. Circle Boulevard
Corvallis, OR 97330

A great number of our users submit unique key sequences to share with other HP owners. Hewlett-Packard will only consider using ideas given freely to us. Since it is the policy of Hewlett-Packard not to accept suggestions given in confidence, the following statement must be included with your submittal:

"All information stated within is submitted to Hewlett-Packard Company without any confidentiality or obligation. I understand that by forwarding this information, no expressed, implied, or confidential relationship is established with Hewlett-Packard. Hewlett-Packard may copyright, distribute, publish, reproduce, dispose of, or use any or all of the information in any way without compensation to me."

Further Information

Service contracts are not available. Calculator circuitry and design are proprietary to Hewlett-Packard, and service manuals are not available to customers.

Should other problems or questions arise regarding repairs, please call your nearest Hewlett-Packard sales office or repair center.

Note: Not all Hewlett-Packard repair centers offer service for all models of HP calculators. However, you can be sure that service may be obtained in the country where you bought your calculator.

If you happen to be outside of the country where you bought your calculator, you can contact the local Hewlett-Packard repair center to see if service capability is available for your model. If service is unavailable, please ship your calculator to the following address:

Hewlett-Packard
1000 N.E. Circle Boulevard
Corvallis, Oregon 97330
U.S.A.

All shipping and reimportation arrangements are your responsibility.

Appendix B

Discounted Cash Flow Analysis

Discounted cash flow analysis is a way of evaluating investments with uneven cash flows. Two forms of discounted cash flow analysis are the net present value (NPV) approach and the internal rate of return (IRR) approach.

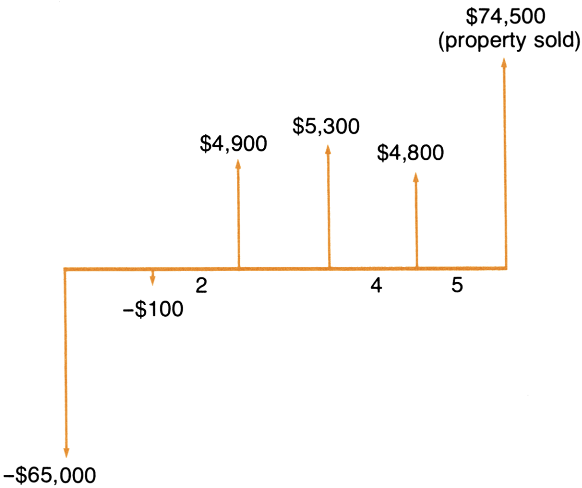
Net Present Value (NPV)

Assuming an interest rate (or desired yield), the net present value method finds the present value of the future cash flows and adds it to the initial cash flow. If this NPV is positive or equal to zero, the investment meets your profit objectives. If the NPV is negative, the investment is not profitable to the extent of the desired yield.

The following procedure for the HP-37E is used to find the net present value of an investment when the assumed yield rate (interest rate or cost of capital), periodic cash flows, and time of occurrence are known. The same procedure is also used if you need to find the present value of a series of cash flows with no initial investment; just key in zero for the initial investment. Use the cash flow sign convention; positive values for cash received and negative values for cash paid out.

1. Key in 1; press [ENTER↑].
2. Key in the desired periodic yield rate (as a percent); press [%] [+] [f] [1/x] [ENTER↑] [ENTER↑] [ENTER↑].
3. Key in the last cash flow; press [×].
4. Key in the next to the last cash flow and press [+] [×].
5. Continue to key in cash flows in reverse order, pressing [+] [×] after each, until all but the initial investment have been entered.
6. Key in the initial cash flow; press [+] to obtain the net present value of the cash flows.

Example: An investor pays $65,000 for a duplex that he intends to keep 5 years and then sell. The first year he knows that he will have to spend a considerable amount for repairs. Will he achieve a desired 9% after-tax yield with the following after-tax cash flows? Note that the duplex is sold for $74,000 during the fifth year.



Keystrokes	Display	
1 [ENTER↑] 9 [%] [+]	1.09	
[f] [1/x]	0.92	
[ENTER↑] [ENTER↑] [ENTER↑]		
74500 [×]	68,348.62	PV at 4^{th} cash flow.
4800 [+] [×]	67,108.83	PV at 3^{rd} cash flow.
5300 [+] [×]	66,430.12	PV at 2^{nd} cash flow.
4900 [+] [×]	65,440.48	PV at 1^{st} cash flow.
100 [CHS] [+] [×]	59,945.39	PV of cash flows.
65000 [CHS] [+]	–5,054.61	Net present value.

Since NPV is negative, the investment does not achieve the desired 9% yield.

Internal Rate of Return (IRR)

Internal rate of return (IRR) is the interest rate that equates the present value of all cash flows with an initial cash flow. IRR is also called the yield or discounted rate of return. The method is to use the net present value approach, trying various rates until a rate is found that causes the NPV to be zero or close to it.

1. Choose a best-guess interest rate, compute the net present value by the previous procedure for NPV.
2. If the net present value is negative, the internal rate of return is lower than the value chosen in step 1. If the net present value is positive, the internal rate of return is higher than the value chosen in step 1.
3. Repeat steps 1 and 2 until the NPV is sufficiently close to zero.

Example: What is the internal rate of return (yield on investment) for an office building costing $115,000 if the cash flows over the next 4 years are as follows:

Year	Cash Flow ($)
1	10,000
2	9,500
3	9,000
4	0
5	140,000 (property sold)

Try 10%:

Keystrokes	Display	
1 ENTER↑ 10 % +	1.10	
f 1/x	0.91	
ENTER↑ ENTER↑ ENTER↑		
140000 ×	127,272.73	PV at 4^{th} cash flow.
0 + ×	115,702.48	PV at 3^{rd} cash flow.
9000 + ×	113,365.89	PV at 2^{nd} cash flow.
9500 + ×	111,696.26	PV at 1^{st} cash flow.
10000 + ×	110,632.97	PV of cash flows.
115000 CHS +	−4,367.03	Net present value at 10%.

Since the NPV is negative, the actual internal rate of return is lower than 10%; therefore, try 9% and repeat the procedure.

Keystrokes	Display	
1 [ENTER↑] 9 [%] [+]	1.09	
[f] [1/x]	0.92	
[ENTER↑] [ENTER↑] [ENTER↑]		
140000 [×]	128,440.37	PV at 4th cash flow.
0 [+] [×]	117,835.20	PV at 3rd cash flow.
9000 [+] [×]	116,362.57	PV at 2nd cash flow.
9500 [+] [×]	115,470.25	PV at 1st cash flow.
10000 [+] [×]	115,110.32	PV of cash flows.
115000 [CHS] [+]	110.32	Net present value at 9%.

This time the NPV is positive, so the IRR is greater than 9%. As a result of these two trials, we know that the IRR is between 9% and 10%. The actual internal rate of return is about 9.02%.

Appendix C

Error Messages

If you press any of the following function keys when the specified condition exists, you attempt an improper calculation. The calculator will display **Error** and a digit from 0 through 5, to aid you in determining the source of the error. Press any key to clear the error message from the display.

Error 0: Zero

[÷], when $x = 0$.
[1/x], when $x = 0$.
[√x], when $x < 0$.
[LN], when $x \leq 0$.
[y^x] 1. When $y = 0$ and $x \leq 0$.
2. When $y < 0$ and x is non-integer.
[Δ%], when $y = 0$.
[PRICE], when $y = 100$.
[%T], when $y = 0$.
[STO][÷] 0 through 6, when $x = 0$.
[n!] 1. When x is non-integer.
2. When $x < 0$.

Error 1: Storage Register Overflow

[12×]
[STO][+] 0 through 6
[STO][÷] 0 through 6
[STO][×] 0 through 6
[STO][−] 0 through 6
[Σ+]
[Σ−]

Error 2: Statistics

Improper data stored in statistical registers R_1 through R_6.

[$\bar{x}$], when $n = 0$.
[s] 1. When $n = 0$ or $n = 1$.
2. When $SS_x < 0$.
3. When $SS_y < 0$.
$\hat{y}$ 1. When $n = 0$.
2. When $SS_x = 0$.
r, when $SS_x \times SS_y \leq 0$.

$R_1 = n$
$R_2 = \Sigma x$
$R_3 = \Sigma x^2$
$R_4 = \Sigma y$
$R_5 = \Sigma y^2$
$R_6 = \Sigma xy$

$SS_x = (R_1)(R_3) - (R_2)(R_2)$
$SS_y = (R_1)(R_5) - (R_4)(R_4)$
$SS_{xy} = (R_1)(R_6) - (R_2)(R_4)$

Error 3: Amortization

AMORT 1. When $x \leq 0$.
2. When x is non-integer.

Error 4: No Such Register

STO 7, 8, 9 RCL 7, 8, 9	Addressing a storage register that does not exist.
STO + 7, 8, 9 STO − 7, 8, 9 STO ÷ 7, 8, 9 STO × 7, 8, 9	Attempting storage register arithmetic in non-existent storage registers.

Error 5: Compound Interest

n, PV, PMT, FV, when $i \leq -100$.

i 1. When PMT = 0 and $n < 0$.
2. When PMT = 0 and $n < .995$.
3. When cash flows are illegal.

n 1. When PMT equals interest amount because any n is a solution.
2. When the values in i, PV, PMT, FV are such that no solution exists for n., e.g., when i = 0.

Error 9: Failed Self-Check

(STO ENTER↑)

Information

This card must be completed and returned with your calculator and/or recharger, and batteries. Return of this card is considered authorization for Hewlett-Packard to make all repairs necessary to return the calculator to normal working order and to charge the cost of those repairs to the owner for units out of warranty.

Owner's Name ______________________ Date ____________

Street Address ______________________

City ______________ State ______________ Zip Code ______________

Home Phone ______________ Work Phone ______________

Date Purchased ______________

What Is The Problem Area?

- ☐ Intermittent Problem
- ☐ Printer (Enclose sample)
- ☐ Keyboard
- ☐ Programming
- ☐ Display
- ☐ Recharger/Battery
- ☐ Prerecorded Program/Reader

Describe Problem: ______________________

____

Model No. ______________ Serial No. ______________

Preferred method of payment for out-of-warranty repairs.

If not specified, unit will be returned C.O.D.

☐ VISA ☐ Master Charge

Card No. ______________ Expiration Date ______________

Name appearing on credit card ______________

☐ Purchase Order. Companies with established Hewlett-Packard credit only. (Include copy of purchase order with shipment.)

P.O. Number ______________

Authorized Signature ______________

Service Card

The warranty period for your calculator and/or accessory is one year from date of purchase. Hewlett-Packard will assume that any unit returned without a copy of proof of purchase (sales slip or validation) is out of warranty. Should service be required, please return your calculator, charger, batteries and this card protectively packaged to avoid in-transit damage. Such damage is not covered under warranty.

Inside the U.S.A.

Return items safely packaged directly to:

Hewlett-Packard
Corvallis Division • Service Department
P.O. Box 999
Corvallis, Oregon 97330

We advise that you insure your calculator and use priority (AIR) mail for distances greater than 300 miles to minimize transit times. All units will be returned by fastest practical means.

Outside the U.S.A.

Where required please fill in the validation below and return your unit to the nearest designated Hewlett-Packard Sales and Service Office. Your warranty will be considered invalid if this completed card is not returned with the calculator.

Model No. ____________________ Serial No. ____________________

Date Received ____________________

Invoice No./Delivery Note No. ____________________

Sold by:

Calculator Catalog and Buying Guide Request Card

Thank you for your order.

A friend or associate might also want to know about Hewlett-Packard calculators. If you would like us to send the current issue of the *Hewlett-Packard Personal Calculator Digest* (The HP Magazine and Product Catalog), please write his/her name and address on this postage-paid Request Card.

Primary Interest:

- ☐ Scientific Calculators
- ☐ Fully-Programmable Calculators
- ☐ Business Calculators
- ☐ All

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