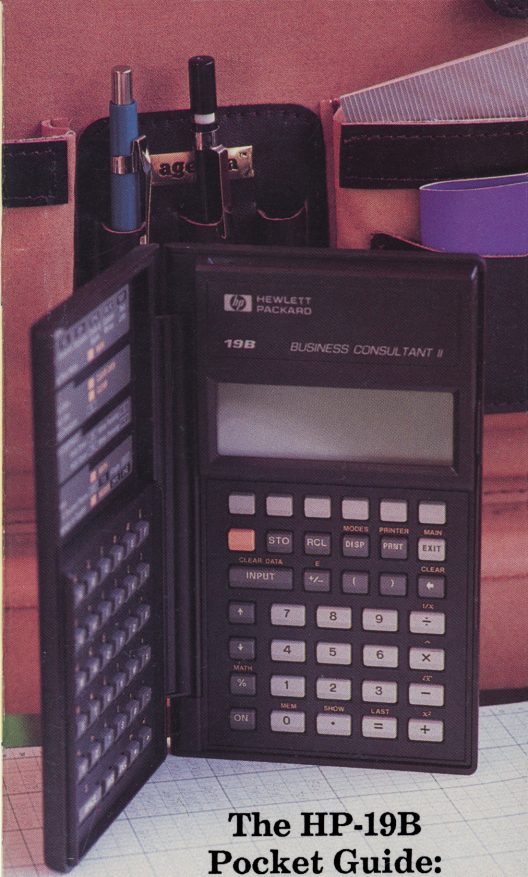

The HP-19B Pocket Guide: Just in Case

A GRAPEVINE PUBLICATION

The HP-19B Pocket Guide: Just In Case

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Dear Reader:

This HP- 19B Pocket Guide is for you to keep in the case with your calculator, for convenient reference...just in case you forget how to work certain kinds of problems.

This booklet is *not* intended to be a replacement for your HP-19B Owner's Handbook, but rather an an easy-to-carry supplement. Because it was designed to fit into your pocket, it includes what we believe are the **most** used financial functions, in brief, concise treatments. *This booklet cannot and certainly does not cover all aspects and functions in your HP-19B.*

The materials it does cover were mostly adapted from our full-length (full-sized) book, titled **An Easy Course In Using The HP-19B**. That Easy Course book is our more complete, in-depth Course, giving you a good understanding of how your HP-19B "thinks" and works. To order the complete Easy Course book, check with your HP dealer, or see the inside back cover here to find out how to order directly.

Now, if you're ready, just check the Index on the outside back cover, find the topic you want to brush up on, and let your Pocket Guide refresh your memory!

The Basics: Arithmetic

You can do arithmetic on the HP- 19B almost anytime, *except* when you see the symbol α appearing at the top of the display, telling you that the calculator is expecting alphabetic input (i.e., characters instead of numbers). If that α appears when you don't want it, press MAIN (the gold key on the right-hand keyboard is the "shift" key, and you must first press it to use any of the functions printed in gold on the keyboard; it acts much like the shift key on a typewriter).

Your calculator has four display lines. The third one down is the Calculator Line, where all arithmetic calculations are performed. To clear this line before starting a problem (not really necessary, actually), just press CLEAR.

The answers here show two displayed decimal places.

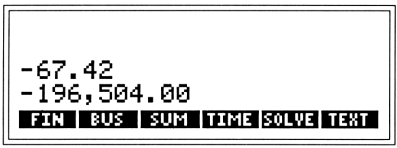
Example: (545 + 264) ÷ -12 = ?
Solution: 5 4 5 + 2 6 4 ÷ − 1 2 =
Answer: -67.42

The machine calculates from left to right as you key in the numbers; you didn't have to use any parentheses in this solution. And notice how easy it is to key in negative numbers.

Example: -484 x (652 - 246) = ?
Solution: [4][8][4][+/−][×][(][6][5][2][−][2][4][6][=]
Answer: -196,504.00

Any open parentheses are closed by the calculator when you press the [=] key. And notice the *other* way you can key in negative numbers – with the [+/−] key.

Here's how your display should look now:



Your previous calculation (-67.42) is now bumped up in the **History Stack**. Use the [↑], [↓] and [LAST] keys to bring values in the History Stack back to the Calculator Line.

Most arithmetic problems are keyed in just as you would say them – including percentages:

Example: Increase 24 by 8%
Solution: [2][4][+][8][%][=]
Answer: 25.92

Example: What is 6% of 54,532 ?
Solution: [5][4][5][3][2][×][6][%][=]
Answer: 3,271.92

Using A Menu

The HP-19B has many built-in formulas and tools which you find through the use of the MAIN menu. For example, here's the MAIN menu (your starting position):

You choose an item on a menu simply by pressing the blank key directly beneath that item.

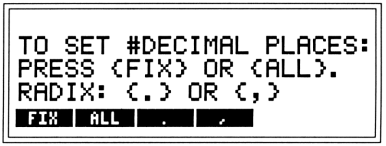
Example: Starting from the MAIN menu, proceed to the TIME menu, then to the SET menu, then *retrace* your steps (back through the TIME menu to the MAIN menu once again).

Keystrokes	**Comments**
MAIN	Always sets the calculator to the MAIN menu.
TIME	Selects the TIME menu.
SET	Selects the SET menu.
EXIT	Goes back to the TIME menu.
EXIT	Goes back to the MAIN menu.

Adjusting The Display

To adjust the **viewing angle** of the display, press *and hold down* the ON key, then press and hold down either the + or − key until the angle is comfortable for your viewing.

To set a certain number of **displayed decimal places**, press the DISP key. The calculator will then show you the following instructions:



The choice **ALL** tells the calculator to display every decimal place *except for trailing zeros.* Thus, for example, the number 8.05446769000 would be displayed as 8.05446769.

The choice **FIX** allows you to set the number of decimal places to be displayed. To set the display to FIX 2 (i.e. for dollars and cents), for example, press DISP **FIX** 2 INPUT.

Those selections, **.** and **,**, on the DISP menu allow you to choose a period or a comma as the "decimal point" in displayed numbers.

Clearing The HP-19B

Three different keys are available for clearing information from the calculator. Exactly what these keys will clear depends upon what you have been doing on the calculator just prior to when you press them.

At the MAIN menu (press MAIN to get there), these clearing functions are:

←: If you are in the middle of keying in a number or an operation on the Calculator Line, this key means "backspace." It clears away one digit or character each time you press it.

However, if a *complete result* is on the Calculator Line, that result is cleared to zero.

CLEAR: Clears (to zero) whatever is on the Calculator Line.

CLEAR DATA: Clears the History Stack and the Calculator Line.

Storing And Recalling Numbers

There are two ways to save numbers – in **registers** and in **lists**.

Registers: The simplest way to save the result of any calculation is in a *numbered storage register*. There are ten such registers, numbered 0-9, and each holds one number at a time.

The [STO] key stores a copy of the most recent number to appear on the Calculator Line.

Example: Calculate 25.3 + 19.8, and meanwhile store 19.8 in register 1.
Solution: [2][5][.][3][+][1][9][.][8] [STO] [1] [=]
Answer: 45.10

The [RCL] key recalls a copy of the current contents of any numbered register.

Example: Add what's in register 1 to the number on the Calculator Line.
Solution: [+] [RCL] [1] [=]
Answer: 64.90

Numbers stored in the numbered data registers will stay there until you change them by storing a new number. To **clear a numbered register**, simply store a 0 in it.

Lists: Lists are used to store **sets** of numbers.

Starting from the MAIN menu, press the SUM key. Your display should look similar to this:

Example: For the past five years, your annual gross income has increased, as shown below. Create a list from this data:

1983	19,200
1984	22,200
1985	24,000
1986	25,000
1987	26,500

Keystrokes	Comments
GET :NEW	This begins a new list. Now just key in the five values, and INPUT after each entry:
1 9 2 0 0 INPUT	
2 2 2 0 0 INPUT	Notice how you always get a running TOTAL of all the data in your list.
2 4 0 0 0 INPUT	
2 5 0 0 0 INPUT	
2 6 5 0 0 INPUT	

Example: Now give your list of incomes a name ("INCOM") so you can use it later. Then return to the MAIN menu.

Keystrokes	Comments
NAME	You're told to type the name and press INPUT.
I N C O M INPUT	Now go back to...
MAIN	...the MAIN menu.

Example: Suppose that upon rechecking your income figures, you discovered that your 1985 income was $24,600 – not $24,000. To edit your list:

Keystrokes	Comments
SUM	Go to the SUM menu.
GET INCO	Open the INCOM list for editing.
↑ ↓ ↓	Move the pointer to the top, then down the list.
2 4 6 0 0 INPUT	Key in the true amount and then press INPUT to replace the previous value.

Notice how the ↑ and ↓ keys move the pointer down and up the list.

Example: Use your INCOM list to calculate your average annual income for the past five years.

Keystrokes	Comments
GET INCOM	Open your INCOM list, if you're not there already.
CALC	Go to the CALC menu.
MEAN	Solve for the average (mean) income.

Answer: MEAN=23,500.00

MAIN	(Return to the MAIN menu.)

Incidentally, anytime you want to delete an item in a list, you would use the DELET command on the SUM menu; anytime you want to insert an item, you can use the INSRT command.

And anytime you want to clear (set to zero) all the items or delete the entire list, you would use CLEAR DATA. It will then give you the options as to what you want to clear or delete.

Business Calculations: Percentages And Markups

Select the **BUS** option from the MAIN menu. Here's what you'll see.

Example: In 1985, your gross income was $24,000, but in 1986 it was $25,000. By what percentage did it change?

Keystrokes	Comments
%CHG	Go from the BUS menu to the %CHG menu.
2 4 0 0 0 **OLD**	Key in your old gross.
2 5 0 0 0 **NEW**	Key in your new gross.
%CH	Solve for the percentage it changed.

Answer: %CHANGE=4.17

Example: If you had received a 7% increase (instead of the 4.17%), what would have been your 1986 gross income?

Keystrokes	Comments
7 %CH	Assume the OLD gross from the last example is still there, so just specify the %CH....
NEW	And solve for the NEW gross that would imply.

Answer: NEW=25,680.00

Example: Last year, out of your gross income of $25,000, you paid $5,602.50 in Social Security, State and Federal income taxes. What is your *effective* tax bracket; that is, what percent of your total gross did you pay in these taxes?

Keystrokes	Comments
%TOTL	Go from the BUS menu to the %TOTL menu.
25000 TOTAL	Key in the TOTAL.
5602.5 PART	Key in the PART.
%T	Calculate this PART's percentage of the TOTAL.

Answer: %TOTAL=22.41

Example: In order to get down to an 18% effective tax bracket, to what level would you have to reduce your total tax bill?

Keystrokes	Comments
1 8 %T	From the previous example, change only the %T, since your TOTAL is still the same.
PART	Solve for the PART this %T would produce.

Answer: PART=4,500.00

Example: A software company buys computer discs for re-sale from a major distributor. The cost of a case of discs is $270.00. The software company then marks the product up to $450.00. What is the markup as a percentage of the cost?

Keystrokes	Comments
MU%C	Go from the BUS menu to the MU%C menu.
2 7 0 COST	Key in the cost.
4 5 0 PRICE	Key in the price.
M%C	Find the Markup as a Percentage of Cost.

Answer: MARKUP%C=66.67

Example: For what price should the software store in the previous example sell the discs to achieve a 70% markup as a percentage of cost?

Keystrokes	Comments
70 M%C	Continuing from the previous problem, just specify your desired M%C (preserving your cost as is).
PRICE	Solve for PRICE.

Answer: PRICE=459.00

Example: A software company buys a case of discs from a distributor for $270.00, then marks it up to $450.00. What is the MARKUP as a percentage of the Price (i.e. the *discount* extended to the software company by the distributor)?

Keystrokes	Comments
MU%P	Go from the BUS menu to the MU%P menu.
270 COST	Key in the COST.
450 PRICE	Key in the PRICE.
M%P	Solve for the the MARKUP as a percentage of Price.

Answer: MARKUP%P=40.00

Example: What would be the software company's COST from the distributor in order to achieve a 45% discount?

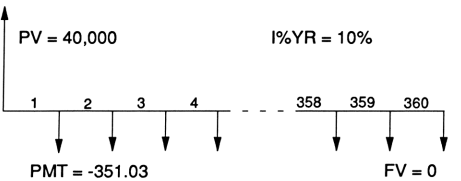
Keystrokes	Comments
45 M%P	Continuing from the previous problem, key in your new discount (M%P)
COST	Solve for the COST.

Answer: COST=247.50

Financial Calculations

From the MAIN menu, press **FIN**. You'll see the following menu:

Any loan, lease or investment is characterized by a certain periodic cash-flow scenario. At specified regular intervals, you either receive money or you pay money, and you represent this on a *cash-flow diagram.* Here's the diagram for a typical mortgage:



This diagram is drawn from the perspective of the borrower. The initial cash-flow is shown as *positive,* to represent the borrowed money *coming in* for the purchase of the house. The payments are shown as *negative,* to represent money *paid out* to whittle away ("amortize") the borrowed money and its interest.

Remember to use the [+/−] key to change numbers back and forth between positive and negative when you are describing a cash-flow diagram to your calculator.

Besides the sign convention, you must also remember these few rules when drawing a cash-flow diagram:

1. The *periods* must be *regular.* A month is a common period, but the period can be quarterly, annual, or any other defined length of time.

2. A cash-flow can be any amount, ***including zero.*** If more than one cash-flow occurs at any *point* in time, then these simultaneous flows may be netted together, but *only one cash-flow can occur per period.* In addition, you may have one initial cash-flow at the beginning of the time-line, and one final cash-flow at the end.

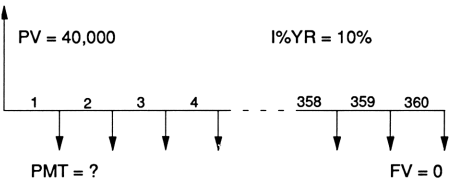
3. The compounding period of the interest must be the same as the payment or cash-flow period described in rule 1 above.

Any cash-flow situation with an identical cash-flow amount (even zero) for each period may be analyzed with the TVM (Time Value of Money) menu. When those amounts are not identical, you'd use the CFLO menu.

A Typical Mortgage (PMT Calculation)

Example: A first-time home buyer has approached you for some advice. She has about $10,000 that she plans to use for the down payment on a house in the $50,000 range. The interest rate is 10% A.P.R. What kind of monthly payment will she have?

First, draw the picture...



Explanation: A typical mortgage is paid off over a 30-year period, although shorter-term mortgages have recently become more popular.

In this diagram, N is the number of periods (30 years is 360 months). PV (Present Value) is the amount financed: $40,000. FV (Future Value) is zero, because the loan will be completely paid off in 360 months. I%YR (annual Interest rate) is 10%, and you may assume the interest also compounds monthly (if not stated otherwise).

Keystrokes	Comments
MAIN FIN TVM	Move to the TVM menu. The top line of the display should show this:
	`12 PMTS/YR: END MODE`
	If not,...
OTHER 1 2 P/YR	set the payments per year, if they're not set to 12 already;
END	and set END MODE (if it's not already set), because the payments occur at the END of each month.
EXIT	Go back to TVM menu.
3 6 0 N 1 0 I%YR	
4 0 0 0 0 PV	Store the known values.
0 FV	Make sure to store zero in FV, because some other number may be there from a previous problem.
PMT	Calculate the payment.

Answer: `PMT=-351.03`

The sign convention makes this result *negative* because from the borrower's point of view (which is how the diagram was "drawn" for the calculator), the payment is paid *out* each month.

PV (Present Value) Calculations

Example: From the previous example, the woman decides she can actually afford $750.00 monthly payments toward principal and interest. What's the highest-priced home she can afford?

Explanation: You need to work the previous example before attempting this one. Much of the value behind the TVM menu is the ability to vary one value to see how it affects another. Here everything is the same as the previous problem, except for the PMT, and now you wish to see how this new payment affects the Present Value (amount financed).

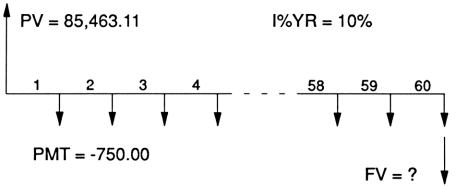
Keystrokes	Comments
7 5 0 +/− PMT	Store the new payment.
PV	Calculate the maximum *loan amount* the woman can afford.

Answer: PV=85,463.11

This is how much the woman can afford to *finance.* So, adding in the amount of the down payment, she can actually look for a house in the $95,000 range.

FV (Future Value) Calculations

Example: Again, refer to the previous example. If the woman now decides to move after exactly 5 years of those $750 payments, what will be the balance left to pay on the mortgage?



Keystrokes	Comments
5 × 12 N	N=60, since she makes 60 payments.
FV	Calculate the balance.

Answer: FV=-82,535.42

Notice on the cash-flow diagram that FV is the amount left to pay immediately after making the 60th regular payment. The calculator does *not* net those two cash-flows – even though they do actually occur at that one point in time.

Both FV and PV are separate from (i.e. over and above) any regular PMT that may occur at the same time!

IRA vs. Property Appreciation

Example: Compare the relative investment merits of an IRA held for 25 years (with annual end-of-the-year deposits of $2000), to a beach-front house acquired at the same time. The house, originally bought for $30,000, is now worth $110,000. If the IRA grows at the same rate as the house, which one is worth more at the end of the 25 years?

Explanation: First find the appreciation rate of the beach house. This will give you the interest rate for the IRA.

Keystrokes	Comments
MAIN FIN TVM	Move to the TVM menu.
OTHER 1 P/YR EXIT	One annual payment.
25 N 30000	
+/- PV 110000	
FV 0 PMT	Store the known values
I%YR	Find the appreciation.
I%YR=5.33	So then...
0 PV 2000	...change values for IRA.
+/- PMT FV	Solve for Future Value.

Answer: FV=99,977.13

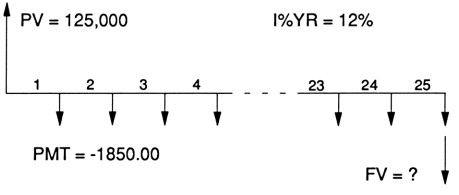
(**Note:** Long-term growth rates on IRA's are typically *much* higher than 5.33%. Try 10%.)

Balloon Payments

Example: You have borrowed $125,000 at 12% A.P.R. At this rate, the interest that accumulates by the end of the first month is 1% of the original balance – which comes to $1250.00, no? So, if $1250 was your exact monthly payment, you would *always* owe the $125,000 principal (i.e. you'd be making *"interest-only payments"*).

After a lengthy discussion with the lender, you decide to make monthly payments of $1850.00, with the remaining balance due at the end of the 25th month in a "balloon payment." How much will that balloon payment be?

Explanation: This example is very similar to the previous one: The FV will be the amount of principal left to pay on the loan after the 25th payment. By paying *more* than just interest (like most mortgage payments), you will have whittled the balance away just a bit by the time the whole note comes due:



Keystrokes	Comments
MAIN FIN TVM	Move to the TVM menu. Check top line of display for # of PMTS/YR: and MODE. If necessary:
OTHER 12 P/YR	Set payments per year.
END	Set END MODE because payments occur at the END of each month.
EXIT	
25 N 12 I%YR	
125000 PV	
1850 +/– PMT	Store the known values.
FV	Calculate the balloon.

Answer: FV=-108,054.08

Remember: This Future Value is the amount you must pay *above and beyond* the final regular payment (so the entire amount paid at that time will be $109,904.08, if you add in the regular payment).

Example: A loan of $58,000 is amortized at 9.25% over 30 years, with the balance due in 15 years. What is the monthly payment and what will be the amount of the balloon payment?

Explanation: The payment is calculated based on a term of 30 years. Then the balloon amount is figured after 15 years of those payments.

Keystrokes	Comments
MAIN FIN TVM	Move to the TVM menu Set PMT/YR:, and END MODE, if necessary.
58000 PV	Store the loan amount.
30 × 12 N	Store the loan term.
9.25 I:YR	Store the interest rate.
0 FV	The loan will amortize *completely* in 30 years.
PMT	Calculate the payment.

Answer: PMT=-477.15

Now it's a simple matter to calculate the balloon payment after a term of 15 years:

Keystrokes	Comments
15 × 12 N	Just 180 payments.
FV	Calculate the balance.

Answer: FV=-46,361.77

Example: Repeat the previous example, but use BEGIN MODE, (payment made at the beginning of the month), to see how this changes the monthly payment and final balloon.

Keystrokes	Comments
MAIN FIN TVM	Move to the TVM menu, if necessary.
OTHER BEG	Set BEGIN MODE, and
EXIT	go back to TVM.
58000 PV	Store the loan amount.
9.25 I%YR	Store the interest rate.
360 N	Number of months.
0 FV	Complete amortization.
PMT	Solve for payment.

Answer: PMT=-473.50

Now solve for the balloon payment at the end of 15 years:

Keystrokes	Comments
15×12 N	15 years = 180 months.
FV	Calculate the balance.

Answer: FV=-46,361.77

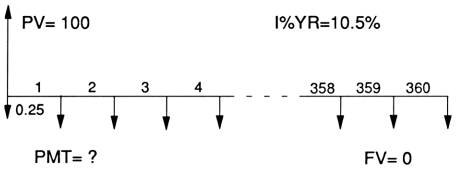
As you can see, the balloon payment stays the same, but meanwhile you're making a slightly *lower* monthly payment.

"Points Up Front" (Prepaid Finance Charges)

Example: The interest rate on F.H.A. loans depends on the amount of finance charge you pay up front (percentage "points up front"). On the day you inquire, the terms on fixed rate, 30-year loans are 10.5% with 1/4 point (0.25% of the loan paid up front), 10.0% with 1/2 point, 9.5 % with 2.5 points, and 9.0% with 4.25 points. Payments and compounding are all monthly. What's the F.H.A. *really* yielding on these loans?

Explanation: The points up front do *not* reduce the payment amount. They don't change anything about the loan except the net amount of money that you are borrowing. F.H.A. will loan you, say, $100.00, but at the same time, you will give them back a quarter (0.25%). Then they will figure your payment based on the full $100.00 loan (at 10.5%), *not* on a $99.75 loan.

To find the true yield, first choose an arbitrary loan amount (any amount will do because it's the interest rate you're concerned with): $100 is simple. Next, you calculate the payment as if there were no "points up front." Then subtract the points from the loan amount (PV) and calculate the actual I%YR.



Keystrokes	Comments
MAIN FIN TVM	Move to the TVM menu. Check top display line for #PMTS/YR: and END MODE.
0 FV	The loan will amortize completely in 30 years.
30 × 12 N	Store the term of loan.
100 PV	Store the loan amount.
10.5 I%YR	Store the interest rate.
PMT	Calculate the payment.
RCL PV −	
0.25% PV	Subtract the points from the loan amount.
I%YR	Solve for the interest rate.

Answer: I%YR=10.53

Repeat the above steps for each of the other three interest rates (starting at 100 PV for each case). The answers are 10.06, 9.79, and 9.49, respectively.

Differing Interest And Payment Periods

When the interest compounding period differs from the payment period (e.g. daily compounding with monthly payments), you need to convert to a new interest rate. This new interest rate will *compound* in accordance to the payment period, but it will *accumulate* the same amount of interest as the old rate. You calculate this new rate with the ICONV (Interest CONVersions) menu.

Annual Payments With Monthly Compounding

Example: You operate a small lumber mill in Oregon's Rogue River Valley. You've borrowed $200,000 for equipment and must make an annual, end-of-the-year payment on the 7-year loan. The interest rate is 7.25% compounded monthly. What is your annual payment?

Explanation: The only burr in this problem is that the payment period differs from the interest period. In such a case, *the payment period always wins out.* So all you need to do is figure an annually- compounding interest rate that is *equivalent* to 7.25% compounded monthly:

Keystrokes	Comments
MAIN FIN ICONV	Move to the Interest CONVersions menu.
PER	Select PER for periodic interest.
7 • 2 5 NOM%	The nominal rate quoted was 7.25%...
1 2 P	...compounded monthly.
EFF%	Calculate the effective annual rate for monthly compounding.

Answer: EFF%=7.50

EXIT EXIT	Leave the ICONV menu.
TVM STO I%YR	Store the correct I%YR. You have to press STO. Otherwise the calculator will think you want to calculate.
OTHER 1 P/YR	Set the number of payments per year.
END	Set END mode if it is not already set.
EXIT 7 N	A 7-year loan.
2 0 0 0 0 0 PV	Loan amount.
0 FV	Paid off in 7 years.
PMT	Calculate the payment.

Answer: PMT=-37,754.63

Quarterly Payments With Monthly Compounding

Example: You borrow $500,000 from your brother, to purchase an apartment complex, at 14.0%, compounded monthly, with quarterly payments (annuity in advance) for 10 years. What is that quarterly payment amount?

Keystrokes	Comments
MAIN FIN TVM	Move to the TVM menu.
10×4 N	40 quarterly payments.
500000 PV	Amount you're loaning.
0 FV	Completely re-paid.
OTHER BEG	Set BEGIN mode.
4 P/YR	Quarterly payments.
EXIT EXIT ICONV	To convert the interest.
PER	One period to another.
14.0 NOM%	The nominal rate.
12 P	Compounded monthly.
EFF%	The equivalent annual rate (14.93%).
4 P NOM%	Quarterly-compounded equivalent (14.16%).
EXIT EXIT	Leave this menu.
TVM STO I%YR	Store the interest rate.
PMT	Calculate the payment.

Answer: PMT=-22,756.92

Canadian Mortgage

Example: A $100,000, 30-year mortgage, with payments in arrears, is written at 15% (Canadian) A.P.R. What is the monthly payment, and what is the equivalent U.S. A.P.R ?

Explanation: In Canada, mortgage payments are usually monthly, but interest compounds semi-annually, so you need to convert between U.S. and Canadian rates before you can "internationally" compare two mortgage A.P.R.'s.

Keystrokes	Comments
MAIN FIN ICONV	Move to ICONV menu.
PER 1 5 NOM%	The 15% PERiodic rate,
2 P	period is semi-annual.
EFF%	Find the EFFective rate.
Answer: EFF%=15.56	Then,
1 2 P	12 monthly payments.
NOM%	Solve for the U.S. A.P.R.
Answer: NOM%=14.55	
EXIT EXIT TVM	Go to the TVM menu.
STO I:YR OTHER	Store this interest rate.
1 2 P/YR END	12 payments/year, etc.
EXIT 3 6 0 N	Store the terms of the
1 0 0 0 0 0 PV	loan.
0 FV PMT	Solve for the payment.
Answer: PMT=-1,228.67	

Amortization Schedules

An amortization schedule is an itemized listing of the principal and interest ("P and I") paid over any given number of periods within the term of a mortgage.

The AMRT menu on your HP-19B is a set of side calculations, much like the ICONV menu, except that they use the values currently sitting in your TVM registers.

Example: You have a straightforward 30-year, fully-amortized mortgage for $90,000 at 9.5% A.P.R., with monthly payments in arrears. Find the amount of interest and principal paid at the end of each year for the first 5 years.

Keystrokes	Comments
FIN TVM	Go to the TVM menu .
OTHER END	Set END mode and
12 P/YR	12 payments per year.
EXIT	
360 N	
9.5 I%YR	
90000 PV	
0 FV	Store terms of loan.
PMT	Solve for the payment.

Answer: PMT=-756.77

Now go to the AMRT menu by pressing OTHER AMRT and follow the display's directions. To amortize 12 payments at once:

Keystrokes	Comments
12 #P	To amortize first 12 payments at once.

Answer:
```
PAYMENTS:1-12
BALANCE=89,445.02
INTEREST=-8,526.26
```

To see the principal paid, press PRIN

Answer:
```
PRINCIPAL=-554.98
```

To amortize the next set of 12 payments, just press NEXT.

Answer:
```
PAYMENTS:13-24
BALANCE=88,834.95
INTEREST=-8,471.17
```

Press PRIN

Answer:
```
PRINCIPAL=-610.07
```

And so on.....

If you have a printer for your HP-19B, press TABLE, follow the display directions, and you'll be able to print out any portion of the amortization schedule.

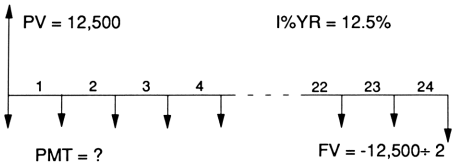
Leases

There is very little difference between a lease and any other investment situation. A lease is simply the lending of valued property, rather than the lending of money itself.

Leases can still be drawn on cash-flow diagrams, and most can be analyzed using the TVM menu (if they have steady payments – and such payments usually are made at the beginning of the month – BEGIN mode). However, if the payment schedule is something *other* than a uniform series, you'll need to use the CFLO menu.

Example: Employees of your company buy their own cars, but then your company leases those cars from the employees, agreeing to pay down the principal on the 48-month loans by exactly half during that time. After that time, the employee owns the car and can sell it or keep it as he or she so chooses. What will the company's monthly lease payments be on an $12,500 car loan at 12.5% interest?

Explanation: This example is simple once you draw the correct picture. The loan amount (PV) is $12,500 and the company agrees to pay that amount down by 50% over two years. The cash-flow diagram looks like this:

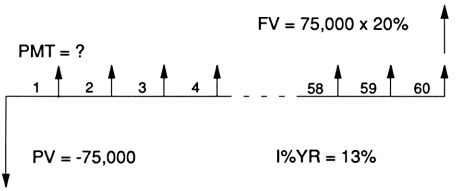


Keystrokes	Comments
MAIN FIN TVM OTHER BEG	Move to the TVM menu.
1 2 P/YR	Set BEGin mode and 12 payments per year.
EXIT	Return to TVM menu.
1 2 5 0 0 PV	Store the loan amount.
÷ 2 +/- FV	Store the amount that the company agrees to pay the loan down to.
1 2 • 5 I%YR	Store the interest rate.
2 4 N	A two-year term.
PMT	Calculate the company's payment.

Answer: PMT=-357.06

Example: You are leasing a $75,000 piece of equipment for 60 months (with payments in arrears), and the residual value is 20% of the price. The payment is based on a 13% annual yield, but then 2 payments are required in advance. Find the payment and the actual yield.

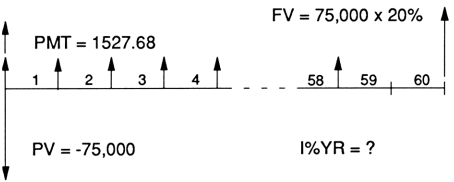
Explanation: The payment is calculated like any loan with a balloon payment: Just amortize it out from the following cash-flow diagram:



Keystrokes	Comments
MAIN FIN TVM	Move to the TVM menu.
OTHER END 12	Set END mode and 12
P/YR	payments per year.
EXIT	Return to TVM menu.
75000 +/- PV	Store the price of the equipment.
× 20 % +/- FV	Store the residual.
13 I/YR	Store the interest rate.
60 N	A five year lease.
PMT	Calculate the payment.

Answer: PMT=1,527.68

Now, if you request two payments up front, how does that affect your yield? Look at this cash-flow diagram:



This diagram correctly describes the actual situation, where two of the regular payments, the ones from the 59th and 60th periods, occur at the beginning of the first period. *But because the final two periods now have no regular monthly payment, you cannot use the TVM menu directly to solve for the true yield.*

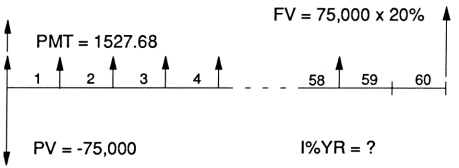
You have to use the CFLO menu.

Press MAIN **FIN** and you'll see that one of your choices is CFLO. Whenever the payments in your cash-flow situation are *uneven,* the CFLO menu is where you'll turn.

Uneven Cash-Flows (CFLO)

You can easily represent almost any cash-flow scenario using the CFLO menu – even when the periodic payments are *not* all the same.

IRR% (Yield)



This is the diagram from the previous example. Remember that you couldn't find the I%YR on this problem with the TVM menu because the payments were not steady and uniform throughout. But with the IRR% calculation from the CFLO menu, you can calculate interest rates or yields for such situations.

Keystrokes	Comments
MAIN	Move to the CFLO menu.
CLEAR DATA...etc.	(Clear current list – or else NAME it and then GET #NEW).

1 5 2 7 • 6 8 ⊗ 2	
− 7 5 0 0 0	Calculate the net initial cash-flow.
INPUT	Store this as the initial cash-flow in the list.
1 5 2 7 • 6 8 INPUT	Store the amount of the first cash-flow group.
5 8 INPUT	There are 58 cash-flows in group 1.
0 INPUT	Account for *every* period on the diagram, even if the amount is zero.
1 INPUT	There's only one of those.
7 5 0 0 0 ⊗ 2 0 %	
INPUT	The last group amount.
1 INPUT	It occurs only once.
CALC IRR%	Calculate the internal rate of return for this cash-flow scenario.
⊗ 1 2 =	Annualize the return.

Answer: 13.81

Unlike the I%YR calculation on the TVM menu, IRR% returns a *periodic* rate that *must be annualized.* In this case, that meant you had to multiply the monthly yield by 12.

So in the lease problem on page 39, the yield changes from 13.50% to 13.81% because of the two payments up front.

"Sliding" Cash-Flows

When you are analyzing a complicated cash-flow scenario, you can often simplify the problem by "sliding" cash-flows forward or backward along the cash-flow diagram to arrive at an easier, equivalent cash-flow diagram.

If you know the prevailing interest rate that applies to a cash-flow diagram, then any single cash-flow can be *moved along the timeline* one or more periods in either direction, *provided that you adjust the amount of that cash-flow according to the prevailing interest rate.*

Remember that this sliding cash-flows is for analysis purposes; it doesn't necessarily represent how the cash-flows would actually occur in the real world; if your banker is looking for regular monthly payments on a loan, he/she probably won't be enthused if you move payments around to come up with an equivalent irregular payment schedule. But the point is, you *can* do this on paper if it helps you to analyze your payments, A.P.R., etc.

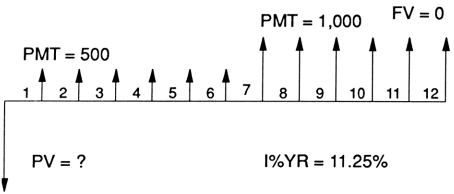
The next few pages look at the concepts and tools used for sliding cash-flows – first the concepts, then the "hands-on" examples to solidify your knowledge of this type of analysis.

NPV (Net Present Value) And NFV (Net Future Value)

The NPV calculations on the CFLO menu are good examples of tools that "slide" cash-flows.

The Net Present Value (NPV) key calculates the total value of all the cash-flows on the current list if they were all "slid" to the left end (the beginning) of the time-line, adjusted according to the periodic interest rate, I%), and summed.

Example: The payment schedule on an 11.25% A.P.R. loan calls for six $500.00 monthly payments followed by six $1000.00 monthly payments (end of the month). What was the original amount of the loan?



Keystrokes	Comments
MAIN FIN CFLO	Move to the CFLO menu.
CLEAR DATA YES	Clear (or name) the current list.

Keystrokes	Comments
0 INPUT	Initial cash-flow is zero.
5 0 0 INPUT	Store the amount of the first cash-flow group.
6 INPUT	6 cash-flows in group 1.
1 0 0 0 INPUT	The second cash-flow group amount is $1000...
6 INPUT	...for six months.
CALC 1 1 • 2 5 ÷ 1 2 I%	With NPV, you must give the *periodic* interest rate, I%.
NPV	Calculate the NPV.

Answer: NPV=8,395.68

All the cash-flows in the list are positive, and yet NPV is also positive. This is different from the PV calculation in the TVM menu. NPV only slides cash-flows, whereas PV is always assuming an investment/return situation and therefore changes the sign (±) on its final answer.

The Net Future Value (NFV) is the same idea as NPV except that the cash-flows are all slid to the *right* (future) end of the time-line. Other than that, everything else is the same; you build the exact same picture of the cash-flow situation, using a CFLO list to describe it.

NUS

The Net Uniform Series (NUS) key does two things: First it calculates the NPV of a cash-flow scenario. Next it "mentally" amortizes this NPV, thus computing the uniform periodic payment amount that would be *equivalent* to the cash-flow scenario described in the current list.

Example: What regular payment is equivalent to the cash-flows of the previous problem?

Solution: After keying in the CFLO list from the previous problem, simply press **NUS** to see that a steady, level payment of $743.00/ month is equivalent to six $500 payments, followed by six $1000 payments, if you assume a periodic (monthly) interest rate of 0.9375.

TOTAL

TOTAL simply adds up all the cash-flow amounts and returns this total. It makes no adjustments for the prevailing interest rate.

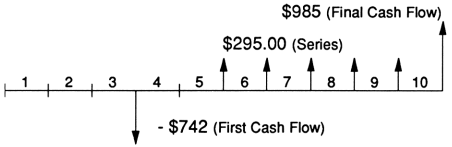
Example: What is the TOTAL of the cash-flows in the current list (keyed in on pages 44-45)?

Solution: Press **TOTAL**: TOTAL=9000.00

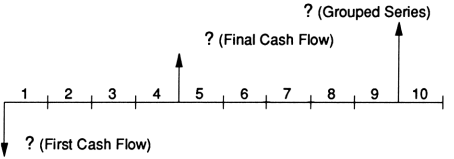
Using The TVM Menu To Slide Cash-Flows

The TVM menu can be used for sliding single cash-flows or for netting a group of even cash-flows. The following examples show how to do this. If you can develop a pictorial understanding of this process, you never have to brush shoulders with the mathematics involved.

Example: On the following cash-flow diagram, move the first cash-flow back (to the left) by three periods, group the series of $295 cash-flows into one cash-flow at the end of the ninth period, and slide the final cash-flow back in time (to the left) by six periods. Use a periodic rate of 0.83%. In other words, take this:



And turn it into this:



Keystrokes	Comments
MAIN FIN TVM	Use the TVM menu.
0 . 8 3 × 1 2	The periodic (monthly)
I%YR	interest rate.
OTHER 1 2 P/YR	Set 12 payments/year...
END	...and END mode.
EXIT	Return to TVM menu.
7 4 2 +/− FV	Store the amount of the first cash-flow to slide.
3 N	Set the number of periods it's going to slide.
0 PMT	No other cash-flows.
PV	Find the Present Value.
+/−	When you use the TVM keys for sliding a cash-flow, you must change the sign on the answer.

Answer: -723.83

0 PV 5 N	Ready to slide the group of cash-flows.
2 9 5 PMT	There are five payments, each $295.
FV	Slide four payments to the right, and add to fifth payment.
+/−	TVM changes the sign.

Answer: 1499.69

Keystrokes	Comments
0 PMT	One more cash-flow to slide – to the left.
985 FV	The amount of the final cash-flow.
6 N	Slide it back six periods.
PV +/–	Calculate the amount after sliding and change the sign.

Answer: 937.34

If you understand the material that has been reviewed in the last few pages, then you have a good grasp of the cash-flow diagram as a dynamic tool for analyzing problems in finance.

The following examples will give you practice in using these concepts in cash-flow analysis, and they may apply directly to the solution that you are looking for within the pages of this Pocket Guide.

Wraparound Mortgage

Example: A property owner wishes to refinance his mortgage. The property has a single mortgage at 10.5% A.P.R. on which he still owes $2,650/month for 48 more months, plus a balloon payment of $75,000 at the end of the 48th month.

He wishes to borrow an additional $35,000 against the value of the property and have you (the lender) assume the payment schedule of the initial mortgage. He would like this debt to you amortized over 20 years with a $40,000 balloon payment.

You agree to wrap his mortgage and to refinance everything at 13.5% plus a finance charge of 2% of the new money loaned. What is the property owner's monthly payment to you and what are you yielding by wrapping his mortgage?

Explanation: This example has to be approached in three steps. The first two steps involve some fairly simple calculations using the TVM menu. Then the third step requires that the results of the first two steps be combined onto one cash-flow diagram to calculate the yield, using IRR% under the CFLO menu.

The first step is to find the unpaid balance on his mortgage, by sliding those payments to the left end of the time-line with a PV calculation:

Keystrokes	Comments
MAIN FIN TVM	Go to the TVM menu.
OTHER 1 2	Set the payments/year…
P/YR END	…and END mode.
EXIT	Back to the TVM menu.
2 6 5 0 +/– PMT	Store the payment.
4 8 N	Store the term.
1 0 • 5 I%YR	Store the original rate.
7 5 0 0 0 +/– FV	Store the balloon.
PV	Calculate the PV.

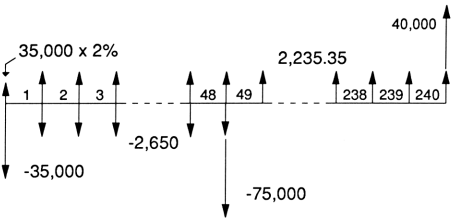
Answer: PV=152,870.58

Next, find a new payment at 13.5% A.P.R., based on the above PV plus $35,000.00:

Keystrokes	Comments
+ 3 5 0 0 0 = +/– PV	Store the new PV.
1 3 • 5 I%YR	The new interest rate.
4 0 0 0 0 FV	The balloon.
2 0 × 1 2 N	20 years of months.
PMT STO 0	Calculate his payment to you and store it.

Answer: PMT=2,235.35

Finally, put the whole shebang on one cash-flow diagram and figure the IRR%:



Keystrokes	Comments
EXIT CFLO	Move to the CFLO menu.
CLEAR DATA YES	Clear the current list.
3 5 0 0 0 +/– –	Calculate the initial cash-flow.
2 %	
INPUT	Store the initial cash-flow.
2 6 5 0 +/– +	Calculate the amount of cash-flow group one.
RCL 0	Fetch the last payment you calculated.
INPUT	Store the amount of cash-flow group one.
4 7 INPUT	That group lasts for 47 periods.

Keystrokes	Comments
[↑][↑]	Move to the previous cash-flow.
[RCL][INPUT]	Bring that cash-flow to the calculator line.
[−][7][5][0][0][0]	Calculate the net 48th cash-flow.
[↓][↓][INPUT]	Store the 48th cash-flow
[INPUT]	It occurs once.
[RCL][0]	Fetch the payment.
[INPUT]	Store the amount of the next cash-flow group.
[2][3][9][−][4][8][INPUT]	That flow happens 191 times.
[↑][↑]	Move to the previous cash-flow.
[RCL][INPUT]	Bring that cash-flow to the calculator line.
[+][4][0][0][0][0][ ][↓]	Add the balloon.
[INPUT]	Store the final cash-flow.
CALC IRR%	Calculate the yield.
[×][1][2][=]	Annualize it.
Answer: 15.15	Not bad.

Variable-Rate Loans

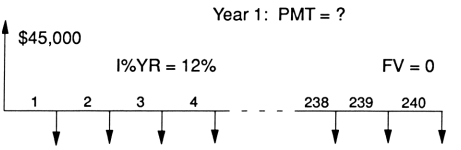
Variable interest rates need to be handled as a series of related but separate problems on any financial calculator, because any single calculation must assume that the interest rate is constant throughout its "part" of the cash-flow line.

Interest rates on variable rate loans are generally tied to some other uncontrollable lending source (like Treasury Bills, or the Prime Rate). Many variable-rate terms have ceilings set to control both the maximum rate and the maximum annual change in that rate.

If you are responsible for quoting payments on a variable rate loan, the only approach is to quote the worst-case scenario. That is, assume interest rates will increase at the maximum rate per year up to the ceiling. A person who agrees to a variable rate loan should be able to handle the payments if this worst-case scenario becomes reality.

Example: You borrow $45,000 with monthly payments for the next 20 years. The interest rate is now 12% A.P.R., but it can increase at 0.5% per year, up to 17%. What's the worst-case scenario for your payments during the first 3 years? What's your maximum payment?

Explanation: In a loan where the rate is adjusted annually like this, you treat each year separately, assuming the interest rate will increase at the maximum allowed rate. You need to calculate the balance owed at the end of each year, and then recalculate the payment due on that balance using the next interest rate, etc.



Keystrokes	Comments
MAIN FIN TVM	Move to the TVM menu. (Set P/YR, etc., if needed).
240 N	
12 I%YR	Store the knowns.
45000 PV	
0 FV PMT	Calculate the payment amount for year 1.

Answer: PMT=-495.49

Keystrokes	Comments
12 N FV	Calculate the balance due at the end of 12 mos.
+/- PV	Store this as PV.
240 − 12 N	Store the new term and
12.5 I%YR	the new interest rate.
0 FV	Re-amortize the loan.
PMT	Calculate the payment amount for year 2.

Answer: PMT=-510.84

12 N FV	Calculate the new balance due at the end of 12 months.
+/- PV	Store this as PV.
240 − 24 N	Store the new term and
13.0 I%YR	the new interest rate.
0 FV	Re-amortize the loan.
PMT	Calculate the payment amount for year 3.

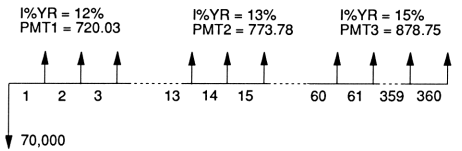
Answer: PMT=-525.93

Now, to calculate the maximum payment, repeat the steps above for each year until you reach an interest rate of 17%. Other than a computer program on a more powerful computer, there are no shortcuts....sorry. After many keystrokes, you'll find the maximum payment (that's in year 11) to be -632.36.

Blended-Rate Mortgage

You can calculate the overall ("blended") interest rate for a variable-rate mortgage.

Example: What is the overall rate earned on this variable-rate mortgage?



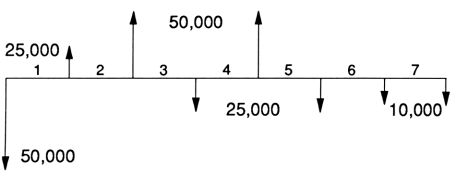
Keystrokes	Comments
MAIN FIN CFLO	Move to the CFLO menu.
CLEAR DATA YES	Clear the current list.
7 0 0 0 0 +/– INPUT	The initial cash-flow.
7 2 0 • 0 3 INPUT	Store the amount of cash-flow group 1.
1 2 INPUT	
7 7 3 • 7 8 INPUT	Store the amount of cash-flow group 2.
6 0 – 1 2 INPUT	There are 48 cash-flows in group 2.
8 7 8 • 7 5 INPUT	Store amount of group 3.
3 6 0 – 6 0 INPUT	There are 300 of these.
CALC IRR%	Find the periodic return.
× 1 2 =	Annualize it.

Answer: 13.81

Modified Internal Rate of Return (MIRR)

Example: You invest $50,000 in a low-income housing project. The project will receive operating loans from several sources, so your investments and returns will be distributed rather unconventionally, alternating a lot, like this:

End of Year	Cash-Flow
0 (initial flow)	$ -50,000
1	25,000
2	50,000
3	-25,000
4	50,000
5	-25,000
6	-10,000
7	-10,000



What would be your yield on this proposed investment scenario?

Explanation: MIRR uses two different discount rates: one to find the NPV of your investments, using a *safe rate;* and one to find the NFV of your returns (positive cash-flows), using a *risk rate.* That is, you slide your negative cash-flows backward and positive ones forward. For this problem, use a safe rate of 5.5% A.P.R., (as in a money market rate), and a risk-rate of 18% A.P.R (as in an aggressive mortgage fund).

Keystrokes	Comments
MAIN FIN CFLO	Move to the CFLO menu.
CLEAR DATA YES	Clear the current list.
5 0 0 0 0 +/– INPUT	The initial cash-flow.
0 INPUT 2 INPUT	Next 2 cash-flows are 0.
2 5 0 0 0 +/–	Next cash-flow is
INPUT INPUT	-25,000.
0 INPUT INPUT	Another cash-flow of 0.
2 5 0 0 0 +/–	Another cash-flow of
INPUT INPUT	-25,000.
1 0 0 0 0 +/–	Last two cash-flows are
INPUT 2 INPUT	each -10,000.
CALC 5 • 5 I%	Use the safe rate here.
NPV	Solve for NPV.

Answer: NPV=-104,545.53

STO 1	Store your answer

Next, EXIT to the list again, and ■ ↑.
Now enter your positive cash-flow list:

Keystrokes	Comments
0 INPUT	Initial cash-flow is 0.
2 5 0 0 0 INPUT INPUT	First cash-flow is 25,000.
5 0 0 0 0 INPUT INPUT	Next cash-flow is 50,000.
↓ ↓	Next cash-flow is 0 (OK).
5 0 0 0 0 INPUT INPUT	Another 50,000.
0 INPUT 3 INPUT	Last three cash-flows (0).
CALC 1 8 I%	
NFV	Solve for NFV.

Answer: NFV=264,028.34

Now, to solve for MIRR:

EXIT EXIT TVM	Move to the TVM menu.
STO FV	Store the previous result (NFV).
RCL 1 STO PV	Recall the NPV of your negative cash-flow list.
7 N	Number of years.
0 PMT OTHER	Payment of 0. Set 1 payment per year, and exit.
1 P/YR END	
EXIT I%YR	Solve for I%YR.

Answer: I%YR=14.15

Creating And Using Your Own Formulas

The HP-19B lets you create your own formulas and use them in menu form, just like you use the built-in ones. From the MAIN menu, press **SOLVE**. The display should now look like this:

Example: As a professional carpetlayer, you often give estimates for carpeting rooms and hallways. Your estimation formula is

$$\text{Cost} = 1.1 \times (\text{Length} \times \text{Width} \times \text{Price}) \div 9$$

with Length and Width measured in feet, and the price is per square yard. Put this formula into your HP-19B.

Solution: At the SOLVE menu, type:

C A R P = 1 • 1 × L E N G T H ×
W I D T H × P R I C E ÷ 9 INPUT.

Here's how it should look when you're finished:

CARP=1.1×LENGTH×WIDTH×PRICE÷9

Example: Using the formula from the previous example, give a quote for carpeting a 12'x15' room with carpet priced at $18 per square yard.

Keystrokes	Comments
CALC	(from the SOLVE menu) lets you use the formula currently displayed.
15 LENG	Key in the length.
12 WIDT	Key in the width.
18 PRICE	Key in the price.
CARP	Solve for estimated cost.

Answer: CARP=396.00

Example: Change your CARP formula to

CARP=1.05×LENGTH×WIDTH×PRICE÷9

Keystrokes	Comments
use the ↑ and ↓	From the SOLVE menu until you're pointing to the CARP formula, then
EDIT	to prepare to edit.
→→→→→→→	Move over to the 1.1.
DEL	Delete the second 1.
INS INS 0 5	Make room for and key in the digits 05.
CALC	Now verify its validity.

Example: Another material you install is wall molding. Your bidding formula for this is:

Molding Cost = 2.1xPrice(Length+Width)

Add this to your HP-19B's list of formulas.

Solution: From the SOLVE menu, press:

MOLDING = 2.1 × PRC × (LENGTH + WIDTH) INPUT.

If all is well, you should then see this:

MOLDING=2.1×PRC×(LENGTH+WIDTH)

Example: Using the molding formula from the previous example, give a bid on a 12'x15' room, with molding priced at $1.00 per foot.

Keystrokes	Comments
CALC	The calculator will verify the molding formula and then present a menu of its variables.
1.000 PRC	Key in the per-foot price.
15 LENG	Key in the room length.
12 WIDT	Key in the room width.
MOLD	Solve for the molding bid.

Answer: MOLDING=56.70

Shared Variables And Formulas

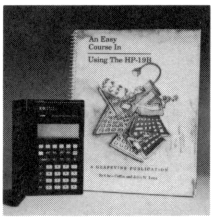
Example: Give one bid for installing carpeting and molding in a 15' x 20' room. The carpet costs $24/square yard; the wall molding is $2.25/foot.

Explanation: The two equations, for CARP and MOLD, *share* two variables, (length and width). To find the total cost, you can therefore write one additional formula, as follows:

TOTAL=CARP+MOLDING

Keystrokes	Comments
CALC	The calculator will verify the TOTAL formula.
EXIT ↑ ↑ CALC	Move to CARP formula.
15 WIDT	Store the width.
20 LENG	Store the length.
24 PRICE	Store the price.
CARP	Solve for carpet price.
Answer: CARP=840.00	
EXIT ↓ CALC	Move to MOLD formula.
2.25 PRC	Enter the price.
MOLD	Solve for molding cost.
Answer: MOLDING=165.38	
EXIT ↓ CALC	Move to TOTAL formula.
TOTAL	Solve for total cost.
Answer: TOTAL=1,005.38	

An Easy Course In Using The HP-19B



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