

Calculator Keystrokes (Get Rich Slow) - Hewlett Packard 12C

Keystrokes for the HP 12C are shown in the following order:

- (1) Quick Start, pages 165-169 of the Appendix. This will provide some basics for using the HP 12C.
- (2) Step 6 of the book, pages 82-89. Here we do a few basic financial calculations.
- (3) Additional Practice Using a Financial Calculator, pages 171-183 of the Appendix.

Quik Start (pages 165-169)

Calculator registers. Most keys have 2 or 3 functions. One appears in white on the face of the key. Some appear in gold *above* the key. Others appear in blue *on the bottom* part of the key. To access the function appearing in gold, press the gold key first; to access the function appearing in blue, press the blue key first.

Turning on and off. To turn on the HP 12C, press [ON]. To turn off, press [ON].

Arithmetic. The HP 12C uses a special language, called RPN. Arithmetic is done differently than on most calculators. For example, to multiply 1,222 by 32.8

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
1,222 [ENTER]	1,222.00	pressing "ENTER" starts a new calculation
32.8 [×]	40,081.60	operator key (×) is pressed <i>after</i> number

Notice, when keying in 1,222 we did not key in a comma (there is no *comma* key). The comma is shown in keystrokes for clarity and will show up in the calculator display. Also, notice that we did not key in the decimal point when entering 1,222; the calculator presumes there is a decimal point at the far right.

Correcting entries. To undo an entry, press [CLX]; doing so erases the displayed value, but does not affect previous numbers of a chain calculation.

Changing sign. The sign of a displayed number can be changed by pressing [CHS].

Setting the decimal. We can select a certain decimal setting, depending on how many digits we want to appear to the right of the decimal point. To set the decimal at, say 8 places, press [GOLD] [8]. To change to 2 places, press [GOLD] [2]. Chain calculations use the *internal*, more accurate number, not the displayed number; if we want to use the displayed number, rather than the internal number, we "round" the internal number to match the displayed number by pressing [GOLD] [RND].

Percent problems. Let's do a few examples.

Example. You buy a duplex for \$350,000. What is the building value, assuming that the building value is 75% of the total price?

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
350,000 [ENTER] 75 [%]	262,500.00	building value

Example. You are thinking of buying an office building. You project the first year's annual rent (called *scheduled rent*) to be \$124,000. You project rents will increase 3% each year. Calculate the projected scheduled rents for Years 2 through 5. Round amounts to the nearest dollar.

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
[GOLD] 0	?.	decimal set at 0 places (to make rounding easier)
124,000 [ENTER] 3 [%] [+]	127,720.	rent for Year 2
3 [%] [+]	131,552.	rent for Year 3
3 [%] [+]	135,498.	rent for Year 4
3 [%] [+]	139,563.	rent for Year 5

Example. You are thinking of buying an office building. You project the first year's scheduled rent to be \$124,000. If you anticipate a vacancy rate of 7%, what is the dollar amount of vacancy, and what amount should you be able to deposit, after vacancy? Round amounts to the nearest dollar.

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
[GOLD] 0	?.	decimal set at 0 places (to make rounding easier)
124,000 [ENTER]	124,000.	scheduled rent
7 [%]	8,680.	dollar amount of vacancy
[-]	115,320.	amount after vacancy
[GOLD] 2	115,320.00	decimal back to 2 places (standard setting)

Time-saving registers. Let's calculate the total monthly rent on a 72-unit apartment building in which 36 units rent for \$850 each, 24 rent for \$900 each, and 12 rent for \$925 each. One approach would be to write down subtotals, then add the subtotals:

36 × \$850	\$30,600
24 × \$900	21,600
12 × \$925	+ 11,100
Total	\$63,300

We could instead use time-saving features of the HP 12C. A few are shown below.

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>use storage registers</i>		
36 [ENTER] 850 [×] [STO] 1	30,600.00	first subtotal, stored in register 1
24 [ENTER] 900 [×] [STO] 2	21,600.00	second subtotal, stored in register 2
12 [ENTER] 925 [×]	11,100.00	third subtotal (no need to store)
[RCL] 1	30,600.00	recalled first subtotal
[+]	41,700.00	added first subtotal to third subtotal
[RCL] 2	21,600.00	second subtotal
[+]	63,300.00	added second subtotal to previous running total
<i>use chain calculation feature</i>		
36 [ENTER] 850 [×]	30,600.00	first subtotal
24 [ENTER] 900 [×]	21,600.00	second subtotal
[+]	52,200.00	second subtotal added to first
12 [ENTER] 925 [×]	11,100.00	third subtotal
[+]	63,300.00	third subtotal added to previous running total

Step 6 of the Book (pages 82-89)

Note: The following pages show keystrokes for the HP 12C for pages 171-183 of the book. The pages do *not* include concepts and explanations unless they pertain specifically to the HP 12C. Please follow along in the book, starting with page 171. When you come to an example, use the keystrokes for the HP 12C, shown here.

With the HP 12C, there is no P/YR register. Instead, the *i*-register is used to enter the periodic rate.

For TVM problems, the HP 12C has a TVM register for each of the five TVM variables (*n*, *i*, PV, PMT, FV); the registers are located at the upper left. We will use a 3-step approach:

1. Clear the TVM registers by pressing [GOLD] [FIN].
2. Enter the given data. Enter dollar amounts *received* as positive numbers and dollar amounts *paid* as negative numbers. Enter the periodic rate in the *i*-register.
3. Solve for the unknown by pressing the register representing the unknown value.

Problem (page 84). 25-year \$300,000 mortgage loan at 6.75% interest. Monthly payment?

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Step 1: clear registers</i>		
[GOLD] [FIN]	???	cleared TVM registers
<i>Step 2: enter given data</i>		
300,000 [PV]	300,000.00	loan amount
25 [ENTER] 12 [×] [n]	300.00	total number of periods
6.75 [ENTER] 12 [÷] [i]	0.56*	periodic rate
<i>Step 3: solve for the unknown</i>		
[PMT]	-2,072.73	monthly payment

* *Note:* By dividing 6.75 by 12 and transferring the result directly into the interest rate register, we enter the *internal, more accurate value* (0.5625), regardless of where we have the decimal set. Don't make the mistake of entering a *rounded rate* (0.56); you will get a wrong answer.

The HP 12C has a shortcut when there are *monthly* periods, as shown below:

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Step 1: clear registers</i>		
[GOLD] [FIN]	???	cleared TVM registers
<i>Step 2: enter given data</i>		
300,000 [PV]	300,000.00	loan amount
25 [BLUE] [n]	300.00	by using the blue key, multiplied 25 by 12
6.75 [BLUE] [i]	0.56	by using the blue key, divided 6.75 by 12
<i>Step 3: solve for unknown</i>		
[PMT]	-2,072.73	monthly payment

Tip: The blue key shortcut shown above is only to be used for monthly periods; don't make the mistake of using the blue key if the compounding period is not monthly.

Problem (page 86). Amortization for that same loan. Assume the first monthly payment is due May 1.

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>clear registers</i>		
[GOLD] [FIN]	???	cleared TVM registers
<i>enter given data</i>		
300,000 [PV]	300,000.00	loan amount
25 [BLUE] [n]	300.00	by using the blue key, multiplied 25 by 12
6.75 [BLUE] [i]	0.56	by using the blue key, divided 6.75 by 12
<i>solve for unknown</i>		
[PMT]	-2,072.73	monthly payment
<i>to amortize accurately, set decimal at 2 places</i>		
[GOLD] 2	-2,072.73	
<i>amortize first 2 payments</i>		
1 [GOLD] [AMORT]	-1,687.50	interest, payment #1
[x/y]	-385.23	principal, payment #1
[RCL] [PV]	299,614.77	unpaid balance after payment #1
1 [GOLD] [AMORT]	-1,685.33	interest, payment #2
[x/y]	-387.40	principal, payment #2
[RCL] [PV]	299,227.37	unpaid balance after payment #2
<i>amortize first 3 calendar years</i>		
300,000 [PV]	300,000.00	must enter original balance in PV register
8 * [GOLD] [AMORT]	-13,438.62	interest, first calendar year (payments 1-8)
[x/y]	-3,143.22	principal, first calendar year
[RCL] [PV]	296,856.78	unpaid balance
12 [GOLD] [AMORT]	-19,885.41	interest, second calendar year
[x/y]	-4,987.35	principal, second calendar year
[RCL] [PV]	291,869.43	unpaid balance
12 [GOLD] [AMORT]	-19,538.16	interest, third calendar year
[x/y]	-5,334.60	principal, third calendar year
[RCL] [PV]	286,534.83	unpaid balance

* *Note:* Because your first monthly payment is due May 1 you will make only eight payments the first calendar year.

When solving cash flow problems on the HP 12C, the cash flow that happens at the beginning of the first period is entered in the [CFo] register; the rest of the cash flows are entered in the [CFj] register. To solve for IRR, press [GOLD] [IRR]. To solve for NPV, first enter the periodic rate in the i-register, then press [GOLD] [NPV].

Problem (page 88). Solve for IRR.

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>clear registers</i>		
[GOLD] [FIN]	???	cleared TVM registers
<i>enter cash flows</i>		
10,000 [CHS] [BLUE] [CFo]	-10,000.00	initial cash flow (entered as a negative)
500 [CHS] [BLUE] [CFj]	-500.00	next cash flow
300 [BLUE] [CFj]	300.00	next cash flow
12,540 [BLUE] [CFj]	12,540.00	final cash flow
<i>solve for IRR</i>		
[GOLD] [IRR]	7.11	IRR

Additional Practice Using the HP 12C

Example 1 (page 172)

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Step 1: clear registers</i>		
[GOLD] [FIN]	?.??	cleared TVM registers
<i>Step 2: enter given data</i>		
500 [CHS] [PV]	-500.00	initial deposit
8 [ENTER] 4 [×] [n]	32.00	total number of periods
6 [ENTER] 4 [÷] [i]	1.50	periodic rate
<i>Step 3: solve for the unknown</i>		
[FV]	805.16	ending balance

In Example 1, we entered the \$500 as a *negative* amount because we *paid* it into the savings plan. The ending balance (\$805.16) is a positive amount because we can take that amount out of the plan if we want to.

Example 2 (page 173)

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Step 1: clear registers</i>		
[GOLD] [FIN]	?.??	cleared TVM registers
<i>Step 2: enter given data</i>		
100 [CHS] [PMT]	-100.00	monthly deposit
45 [BLUE] [n]	540.00	by using blue key, multiplied 45 by 12
6 [BLUE] [i]	0.50	by using blue key, divided 6 by 12
<i>Step 3: solve for FV, begin mode</i>		
[BLUE] [BEG]	0.50	notice the word BEGIN in bottom of display
[FV]	276,977.26	ending balance, begin mode
<i>Step 3: solve for FV, end mode</i>		
[BLUE] [END]	276,977.26	notice the word BEGIN <i>not</i> in display
[FV]	275,599.26	ending balance, end mode

Tip: The blue key shortcut shown above is only to be used for monthly periods; don't make the mistake of using the blue key if the compounding period is not monthly.

Example 3 (page 174)

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Step 1: clear registers</i>		
[GOLD] [FIN]	?.??	cleared TVM registers
<i>Step 2: enter given data</i>		
25,000 [FV]	25,000.00	amount you want to accumulate
1,500 [CHS] [PV]	-1,500.00	initial one-time deposit
5 [BLUE] [n]	60.00	by using the blue key, multiplied 5 by 12
7 [BLUE] [i] *	0.58	by using the blue key, divided 7 by 12
<i>Step 3: solve for unknown</i>		
[PMT]	-319.49	required monthly deposit

* *Note:* By dividing 7 by 12 and transferring the result directly into the interest rate register, we enter the *internal, more accurate value* (0.5833333333), regardless of where we have the decimal set. Don't make the mistake of entering a *rounded rate* (0.58); you will get a wrong answer.

Example 4 (page 174-175)

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Step 1: clear registers</i>		
[GOLD] [FIN]	?.??	cleared TVM registers
<i>Step 2: enter given data</i>		
1,050 [CHS] [PV]	-1,050.00	purchase price
1,000 [FV]	1,000.00	maturity value
35 [PMT]	35.00	semiannual interest payment
18 [ENTER] 2 [×] [n]	36.00	total number of periods
<i>Step 3: solve for unknown</i>		
[i]	3.26	periodic rate
2 [×]	6.52	annual rate

If you buy the bond, you will earn 6.52% compounded semiannually. Notice, when you solve for “*i*” you get 3.26. But, remember, the *i*-register represents the interest rate *per period*, in this case the interest rate for each 6 months. To calculate the yield, we multiply the periodic rate (3.26) by the periods per year (2), getting 6.52%.

Example 5 (page 175-176)

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Step 1: clear registers</i>		
[GOLD] [FIN]	?.??	cleared TVM registers
<i>Step 2: enter given data</i>		
1,200 [PV] *	1,200.00	premium (amount borrowed)
230 [CHS] [PMT]	-230.00	monthly payment
6 [n]	6.00	number of periods
[BLUE] [BEG] **	6.00 BEGIN	begin mode
<i>Step 3: solve for unknown</i>		
[i]	5.96	periodic rate
12 [×] ***	71.47	annual rate
[BLUE] [END] ****	71.47	back in end mode

* You are, in effect, borrowing the \$1,200, so treat it as a *positive* PV.

** Because the first payment of \$230 is due today, put in *begin* mode.

*** When we solve for the interest rate (5.96), we have solved for the interest rate per period (per month); to get the *annual* rate, we must multiply by 12. You may think we should multiply by 6 since you make payments for 6 months, but to get the annual rate we multiply by 12 (not 6), because there are 12 months in a year.

**** The majority of TVM problems are in *end-mode*, so it is recommended that you put your calculator back in *end-mode* immediately after finishing a *begin-mode* problem.

Example 6 (page 176-177)

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Step 1: clear registers</i>		
[GOLD] [FIN]	?.??	cleared TVM registers
<i>Step 2: enter given data</i>		
1,400 [PMT]	1,400.00	monthly payment
120 [n]	120.00	number of periods
8.5 [BLUE] [i]	0.71	periodic rate, rounded
<i>Step 3: solve for unknown</i>		
[PV]	-112,916.26	amount to pay

Example 7 (page 177)

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Step 1: clear registers</i>		
[GOLD] [FIN]	?.??	cleared TVM registers
<i>Step 2: enter given data</i>		
222,094.44 [PV]	222,094.44	loan balance
6.25 [BLUE] [i]	0.52	periodic rate, rounded
1,539.29 [CHS] [PMT]	-1,539.29	monthly payment
<i>Step 3: solve for unknown</i>		
[n]	268.00	remaining number of payments

With the HP 12C, when we solve for n , the answer is rounded up to the next whole number.

You have another 268 months (22 years and 4 months) until the loan will be paid off. The PI portion of the payment is \$1,539.29; the TI portion (\$310) does not apply to the debt. We entered the \$1,539.29 payment as a *negative* because you will be *paying* it. We entered the \$222,094.44 as a positive number.

Example 8 (page 179)

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
[GOLD] [FIN]	?.??	cleared TVM registers
<i>calculate payment, Year 1</i>		
[GOLD] 2	?.??	to amortize correctly, set decimal at 2 places
60,000 [PV]	60,000.00	loan amount
7.5 [BLUE] [i]	0.63	periodic rate, rounded, Year 1
30 [BLUE] [n]	360.00	number of periods
[PMT]	-419.53	monthly payment, Year 1
<i>calculate payment, Year 2</i>		
12 [GOLD] [AMORT]	-4,481.23	interest, first 12 payments
[RCL] [PV]	59,446.87	balance
8.25 [BLUE] [i]	0.69	periodic rate, rounded, Year 2
29 [BLUE] [n]	348.00	remaining number of payments
[PMT]	-450.18	monthly payment, Year 2
<i>calculate payment, Year 3</i>		
12 [GOLD] [AMORT]	-4,485.11	interest, second 12 payments
[RCL] [PV]	58,929.82	balance
8.125 [BLUE] [i]	0.68	periodic rate, rounded, Year 3
28 [BLUE] [n]	336.00	remaining number of payments
[PMT]	-445.11	monthly payment, Year 3

In this example, we first found a payment for a 30-year 7.5% \$60,000 loan; for the second year, we found a payment for a 29-year 8.25% \$59,446.87 loan; and for the third year, we found a payment for a 28-year 8.125% \$58,929.82 loan.

Example 9 (page 180)

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
[GOLD] [FIN]	?.??	cleared TVM registers
<i>calculate PMT</i>		
100,000 [PV]	100,000.00	loan amount
8.5 [BLUE] [i]	0.71	periodic rate, rounded
30 [BLUE] [n]	360.00	number of periods
[PMT]	-768.91	monthly payment
<i>balloon payment</i>		
[GOLD] 2	-768.91	to amortize correctly, set decimal at 2 places
120 [GOLD] [AMORT]	-80,872.42	interest, first 120 payments
[RCL] [PV]	88,603.22	balance after payment 120
768.91 [+]	89,372.13	balloon payment

The balloon payment is \$89,372.13. Notice, the balloon payment is *not* \$88,603.22 (the balance after payment 120 is credited); this is because payment 120 is due at the same time as the balloon payment. So, instead of writing out a check for \$768.91 (for payment 120) and another for \$88,603.22, you write one check for the total (\$89,372.13).

Example 10 (page 182)

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
[GOLD] [FIN]	?.??	cleared TVM registers
<i>calculate PMT</i>		
300,000 [PV]	300,000.00	loan amount
7 [BLUE] [i]	0.58	periodic rate, rounded
30 [BLUE] [n]	360.00	number of periods
[PMT]	-1,995.91	monthly payment
<i>find balance after 8 years (set decimal at 2 places)</i>		
96 [GOLD] [AMORT]	-160,081.92	interest, first 96 payments
[RCL] [PV]	268,474.56	unpaid balance
<i>enter FV and change N & PV</i>		
[CHS] [FV]	-268,474.56	put unpaid balance in FV register as a negative
96 [n]	96.00	put 96 in the n-register
300,000 [ENTER] 7,400 [-] [PV]	292,600.00	put net proceeds in PV register
[i]	0.62	periodic rate
12 [x]	7.43	APR

Example 11 (page 183)

<u>HP 12C keystrokes</u>	<u>display</u>	<u>explanation</u>
[GOLD] [FIN]	?.??	cleared TVM registers
<i>enter cash flows</i>		
0 [BLUE] [CFo]	0.00	no cash flow at beginning of first period
800 [BLUE] [CFj] 82 [BLUE] [Nj]	82.00	next cash flow happened 82 times
950 [BLUE] [CFj] 99 [BLUE] [Nj]	99.00	limited to two-digit number for Nj register
950 [BLUE] [CFj] 21 [BLUE] [Nj]	21.00	remaining 21 payments of \$950
<i>solve for NPV</i>		
8.5 [BLUE] [i]	0.71	periodic rate, rounded
[GOLD] [NPV]	92,581.28	price to pay

To review cash flows in the HP 12C, press [RCL] 0, [RCL] 1, [RCL] 2, etc.