

# LeWORLD FINANCIAL Calculator

Keystrokes for the LeWORLD financial calculator are very similar to the TI BAI PLUS, shown in the text; there are a few differences. Keystrokes are shown for a few topics in which keystrokes are unique. Start by reading the Quik Start section. Then, before beginning a specific unit of the text, check to see if this includes keystrokes for that unit. Going through the keystrokes before class will help, especially if your instructor cannot include instructions for your calculator during class.

## Quik Start

**Calculator registers.** Most keys have 2 functions. One appears in white on the face of the key. The second function appears in orange above the key. To access the second function, press [2nd] first.

**Arithmetic.** Arithmetic can be done as shown below. Example: Multiply 1,222 by 32.8

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
1,222 [ × ] 32.8 [ = ]	40,081.60	answer

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.

**Worksheets.** LeWORLD financial calculator has two modes of operation: the *standard-calculator mode* and the *worksheet mode* (designed to guide us through special applications). There are 12 worksheets. To access a worksheet, press the key(s) to select the worksheet. For example, to access the amortization worksheet, press [2nd] [AMORT]; to return to the *standard-calculator mode*, press [2nd] [QUIT].

**Correcting entries.** If we enter a number incorrectly, we can correct our mistake without having to start the problem over again. Pressing the backspace key [⇒] gobbles up the last digit. Pressing [C/CE] clears the entire displayed number.

**Changing sign.** The sign of a displayed number can be changed by pressing [+/-].

**Setting the decimal.** To set the decimal at, say, 8 places, press [2nd] [FORMAT] 8 [ENTER] [2nd] [QUIT]. For a floating decimal (in which trailing zeros are dropped), set the decimal at 9 places. If we get an answer in the display but want to view more digits than the current decimal setting will allow, we must first store the displayed number by pressing [STO] 1, then change the decimal setting as outlined above, and finally recall the number by pressing [RCL] 1. For chain calculations, the TI BAI PLUS uses 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 [2nd] [RND] .

**Time-saving registers.** Suppose we want to 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 subtotals:

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

Here are a few approaches that can be used to save time:

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>use storage registers</i>		
36 [ × ] 850 [=]	30,600.00	first subtotal
[STO] 1	30,600.00	stored in register 1
24 [ × ] 900 [=]	21,600.00	second subtotal
[STO] 2	21,600.00	stored in register 2
12 [ × ] 925 [=]	11,100.00	third subtotal
[ + ] [RCL] 1	30,600.00	first subtotal, recalled
[ = ]	41,700.00	result
[ + ] [RCL] 2	21,600.00	second subtotal, recalled
[ = ]	<b>63,300.00</b>	total
<i>use parentheses</i>		
36 [ × ] 850 [=]	30,600.00	first subtotal
[ + ] ( 24 [ × ] 900 )	21,600.00	second subtotal
[ + ] ( 12 [ × ] 925 )	11,100.00	third subtotal
[ = ]	<b>63,300.00</b>	total

## Chapters 10 & 11 Compound interest formulas

Using a calculator properly is essential in working with the compound interest formulas of Illustration 10-1. An example will be given for each of the 8 compound interest formulas. We will begin with Formula 1A. Before starting, here are a few things worth noting:

- *There are several ways to do the arithmetic; the keystrokes shown in this section are only one choice.* The keystrokes shown may, in some cases, be longer than another method but are used because the method is considered to be more conceptually sound and easier to remember.
- *Here is a tip:* Try your own keystrokes before looking at ours. If your approach makes sense, use it because it will be easier to remember. If you have difficulty, then review our suggested keystrokes.
- The displayed values shown in the keystrokes have 2 decimal places. Having our decimal set at more or less places will not affect the final answer, provided we use chain calculations (remember that chain calculations use the internal, more accurate value, not the displayed value).

## Formula 1A

### Example 1 of Unit 10.2

You get an income tax refund of \$1,700 and deposit the money in a savings plan for 6 years, earning 6% compounded quarterly. Find the ending balance using compound interest formulas.

$$FV = PV(1 + i)^n = \$1,700(1.015)^{24} = \mathbf{\$2,430.15}$$

#### keystrokes

1.015 [y<sup>x</sup>] 24 [=]  
[×] 1,700 [=]

#### display explanation

1.43 1.015 to the 24th power  
**2,430.15** answer

### Example 2 of Unit 10.2

Suppose a “wise man” had deposited \$1 in a savings account 2,000 years ago and the account earned interest at 2% compounded annually. If the money in the account today were evenly divided among the world’s population, how much would each person receive, based on a world population of 7 billion?

$$FV = PV(1 + i)^n = \$1(1.02)^{2000} \quad \text{Then divide by 7,000,000,000.}$$

#### keystrokes

1.02 [y<sup>x</sup>] 2,000 [=]  
[÷] 7,000,000,000 [=]

#### display explanation

1.586147 17 account balance, in scientific notation  
**22,659,247.54** amount per person

## Formula 1B

### Example 4, Unit 10.2

You deposit \$100 at the end of each year for 4 years, earning 6% compounded annually. Use compound interest formulas to find the balance in 4 years.

$$FV = PMT \left[ \frac{(1 + i)^n - 1}{i} \right] = \$100 \left[ \frac{(1.06)^4 - 1}{.06} \right] = \mathbf{\$437.46}$$

#### keystrokes

1.06 [y<sup>x</sup>] 4 [=] [-] 1 [=]  
[÷] .06 [=]  
[×] 100 [=]

#### display explanation

0.26 value of numerator  
4.37 value inside of brackets  
**437.46** FV

## Formula 2A

### Example 1 of Unit 10.3

Your aunt says she will give you \$2,430.15 in 6 years. Assuming that you can earn 6% compounded quarterly, what is the real value of her promise, in today’s dollars?

$$PV = \frac{FV}{(1 + i)^n} = \frac{\$2,430.15}{(1.015)^{24}} = \mathbf{\$1,700.00}$$

#### keystrokes

1.015 [y<sup>x</sup>] 24 [=]  
[STO] 1  
2,430.15 [÷] [RCL] 1  
[=]

#### display explanation

1.43 value of denominator  
1.43 this value is stored in register 1  
1.43 recalled the value  
**1,700.00** answer

## Formula 2B

### Example 2 of Unit 10.3

You are selling a valuable coin. You have two offers. The first offer is for \$5,500 cash. With the second offer, the buyer will pay you \$2,000 at the end of each year for 3 years. Assuming that you can earn 8% compounded annually on your money, which offer is better?

$$PV = PMT \left[ \frac{1 - \frac{1}{(1+i)^n}}{i} \right] = \$2,000 \left[ \frac{1 - \frac{1}{(1.08)^3}}{.08} \right] = \mathbf{\$5,154.19}$$

#### keystrokes

1.08 [y<sup>x</sup>] 3 [=]  
[1/x]  
[+/-]  
[+] 1 [=]  
[÷] .08 [=]  
[×] 2,000 [=]

#### display explanation

1.26 1.08 to the third power  
0.79 1 over (1.08 to the third power)  
-0.79 changed the sign  
0.21 value of the numerator  
2.58 value inside the brackets  
**5,154.19** answer

## Formula 3

### Example 1 of Unit 11.4

Dale bought a rare baseball card 3 years ago for \$1,500. He just sold the card for \$2,000 to get some money for his college tuition. What interest rate, compounded annually, did Dale earn on the investment?

$$i = \left( \frac{FV}{PV} \right)^{\frac{1}{n}} - 1 = \left( \frac{\$2,000}{\$1,500} \right)^{\frac{1}{3}} - 1 = .100642 \approx \mathbf{10.0642\%}$$
 (with 4 decimal places)

#### keystrokes

2,000 [÷] 1,500 [=]  
[y<sup>x</sup>] 3 [1/x] [=]  
[-] 1 [=]  
[STO] 1  
[2nd] [FORMAT] 6 [ENTER] [2nd] [QUIT]  
[RCL] 1  
[2nd] [FORMAT] 2 [ENTER] [2nd] [QUIT]

#### display explanation

1.33 value inside of parentheses  
1.10 previous value to the 1/3 power  
0.10 rate, in decimal form, with decimal at 2  
0.10 stored in register 1  
0.000000 set decimal at 6 places  
**0.100642** rate, in decimal form, with decimal at 6  
0.00 put decimal back to 2 places

## Formula 4A

### Example 2 of Unit 11.1

You want to accumulate \$200,000 for retirement in 40 years. You can earn 6.75% compounded monthly. What amount must you deposit at the end of each month in order to accumulate \$200,000 in 40 years?

$$PMT = \frac{FV(i)}{(1+i)^n - 1} = \frac{\$200,000(.005625)}{(1.005625)^{480} - 1} = \mathbf{\$81.71}$$

#### keystrokes

1.005625 [y<sup>x</sup>] 480 [=] [-] 1 [=]  
[STO] 1  
200,000 [×] .005625 [=]  
[÷] [RCL] 1  
[=]

#### display explanation

13.77 value of denominator  
13.77 stored the value  
1,125.00 value of numerator  
13.77 denominator, recalled  
**81.71** answer

## Formula 4B

### Example 2 of Unit 11.2

Suppose you have accumulated \$500,000, perhaps from many years of savings or from an inheritance. You put the money in a savings plan earning 6% compounded monthly. You want the plan to last 40 years. How much can you withdraw at the end of each month?

$$PMT = \frac{PV(i)}{1 - \frac{1}{(1+i)^n}} = \frac{\$500,000(.005)}{1 - \frac{1}{(1.005)^{480}}} = \mathbf{\$2,751.07}$$

#### keystrokes

1.005 [y<sup>x</sup>] 480 [=]  
[1/x]  
[+/-]  
[+] 1 [=]  
[STO] 1  
500,000 [×] .005 [=]  
[÷] [RCL] 1  
[=]

#### display explanation

10.96 1.005 to the 480<sup>th</sup> power  
0.09 1 over (1.005 to the 480<sup>th</sup> power)  
-0.09 changed the sign  
0.91 value of denominator  
0.91 stored the value  
2,500.00 value of numerator  
0.91 recalled the denominator  
**2,751.07** answer

## Formula 5

### Example 3 of Unit 11.1

You want to start a restaurant business and estimate it will take \$28,000 to get started. You currently have \$3,000 and can deposit an additional \$425 at the end of each month. If your savings will earn 9% compounded monthly, in how many months can you start your business?

For Formula 5 we must use proper sign convention for PV, FV, and PMT:

PV = negative \$3,000 (negative because you pay this amount into a savings plan)

FV = \$28,000 (positive because you will get this amount back from the savings plan)

PMT = negative \$425 (negative because you pay this amount into a savings plan)

$$n = \frac{-\ln\left(\frac{PV + \left(\frac{PMT}{i}\right)}{\frac{PMT}{i} - FV}\right)}{\ln(1+i)} = \frac{-\ln\left(\frac{-\$3,000 + \left(\frac{-\$425}{.0075}\right)}{\frac{-\$425}{.0075} - \$28,000}\right)}{\ln(1.0075)} = \mathbf{46.83 \text{ months}}$$

### keystrokes

### display explanation

*Step 1: Compute and store (-\$425 over .0075)*

425	[+/-]	[÷]	.0075	[=]	-56,666.67	value of (- \$425 over .0075)
[STO]	1				-56,666.67	stored in register 1

*Step 2: Compute and store the bottom half of the numerator*

[-]	28,000	[=]			-84,666.67	value of the bottom half of the numerator
[STO]	2				-84,666.67	stored in register 2

*Step 3: Compute and store the value of the entire numerator*

[RCL]	1				-56,666.67	recall value of (- \$425 over .0075)
[-]	3,000	[=]			-59,666.67	value of the top half of the numerator
[÷]	[RCL]	2			-84,666.67	recall bottom half of the numerator
[=]					0.70	total value inside of large brackets
[LN]					-0.35	the natural log of the previous value
[+/-]	[STO]	3			0.35	entire numerator stored in register 3

*Step 4: Compute and store the value of the main denominator*

1.0075	[LN]				0.01	the natural log of 1.0075
[STO]	4				0.01	main denominator stored in register 4

*Step 5: Get answer*

[RCL]	3				0.35	recall the value of the entire numerator
[÷]	[RCL]	4			0.01	recall the value of the main denominator
[=]					<b>46.83</b>	answer

## Chapters 14, 15, and 19 Financial calculators

Keystrokes will be shown for problems in which keystrokes are unique—those same examples of the text that show keystrokes for the HP 10BII and the TI BAII PLUS.

The 5 TVM keys are located on the 5<sup>th</sup> row. We will let the *I/y* register represent the *interest rate per period*, and the “N” register represents the total number of periods. Keystrokes assume calculator is set at 1 period per year, and is in “End” mode. To set the P/Y to 1, press [2nd] [P/Y] 1 [ENTER] [2nd] [QUIT]. To change to “Begin” mode, press [2nd] [BGN] [2nd] [SET] [2nd] [QUIT]; to change back to “End” mode, press [2nd] [P/Y] [2nd] [SET] [2nd] [QUIT].

The LeWorld Financial Calculator has a [CLR TVM] register, but it does *not* clear the 5 TVM registers; instead it changes the P/Y setting to a default value of 12. Because we want to leave the P/Y set at 1 forever, we will not use the [CLR TVM] register. By having no way to clear the TVM variables, we must make sure we enter zero in an unused register; to help avoiding leaving unwanted data in an unused register, we will enter data in the registers from left to right: N, I/y, PV, PMT, and FV.

### Example 1 of Unit 14.2

Sebastian Xavier is a soda pop “addict” and wonders how much money he could accumulate if he stopped drinking soda pop and deposited the \$150 per month he spends on the stuff into a savings plan. Sebastian just turned 20. If his savings plan earns 6% compounded monthly and his first deposit is a month from now, what amount would he have at retirement, 40 years from now?

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Set P/Y to 1</i>		
[2nd] [P/Y] 1 [ENTER] [2nd] [QUIT]	0.00	P/Y set at 1; leave that way for life
<i>Enter given data</i>		
40 [×] 12 [=] [N]	480.00	total number of periods
6 [÷] 12 [=] [I/y]	0.50	periodic rate
0 [PV]	0.00	there is no one-time initial deposit
150 [+/-] [PMT]	-150.00	amount deposited ( <i>paid</i> )
<i>Solve for unknown</i>		
[CPT] [FV]	<b>298,723.61</b>	balance in 40 years

### Example 2 of Unit 14.2

You have the chance to buy a promissory note in which you would receive 28 quarterly payments of \$500, starting 3 months from now. If you want to earn 8% compounded quarterly, what price should you pay for the note?

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Enter given data</i>		
28 [N]	28.00	total number of periods
8 [÷] 4 [=] [I/y]	2.00	periodic rate
500 [PMT]	500.00	quarterly payment ( <i>received</i> )
0 [FV]	0.00	there is no one-time payment at the end of last period
<i>Solve for unknown</i>		
[CPT] [PV]	<b>-10,640.64</b>	amount you can pay to earn 8% compounded quarterly

### Example 5 of Unit 14.3

You deposit \$100 at the beginning of each year for 4 years, earning 6% compounded annually. Find the balance in 4 years.

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>Enter given data</i>		
4 [N]	4.00	total number of periods
6 [I/y]	6.00	rate
0 [PV]	0.00	there is no initial one-time initial deposit
100 [+/-] [PMT]	-100.00	amount deposited ( <i>paid</i> )
<i>Solve for unknown</i>		
[2nd] [BGN] [2nd] [SET] [2nd] [QUIT]	0.00	“BGN” in display
[CPT] [FV]	<b>463.71</b>	balance assuming deposits at <i>beginning</i> of each year
[2nd] [BGN] [2nd] [SET] [2nd] [QUIT]	0.00	back in end mode; “BGN” no longer in display

### Example 1 of Unit 19.1

Tara got a \$160,000 15-year mortgage loan at 7.25% on April 1. Calculate her monthly payment. Then, using the amortization registers of your calculator, find interest, principal, and remaining balance for the first two payments.

*Note:* To get accurate results when amortizing, we must have the decimal set at 2 places. Once we get in the Amortization Worksheet, we can find interest, principal, and remaining balance for any series of payments. To select the series of payments, P1 is the beginning payment number of that series and P2 is the ending payment number of that series. For example, if we want to know interest, principal, and ending balance for payments 35 through 72, we set P1 at 35 and P2 at 72, then scroll down to see interest, principal, and balance for that series.

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>calculate monthly payment</i>		
15 [×] 12 [=] [N]	180.00	180 months
7.25 [÷] 12 [=] [I/y]	0.60	periodic rate = 0.60
160,000 [PV]	160,000.00	loan amount
0 [FV]	0.00	there is no future value
[CPT] [PMT]	<b>-1,460.58</b>	monthly payment
<i>amortize (must have decimal at 2)</i>		
[2nd] [AMORT]	P1=1.00	asking for beginning payment number for series
1 [ENTER]	P1=1.00	we want to slice out payment 1 through 1
↓	P2=1.00	asking for ending payment number for series
1 [ENTER]	P2=1.00	ending payment number
↓	<b>BAL=159,506.09</b>	balance after payment 1
↓	<b>PRN= -493.91</b>	principal, payment 1
↓	<b>INT= -966.67</b>	interest, payment 1
↓	P1=1.00	asking for beginning payment number of next series
2 [ENTER]	P1=2.00	beginning payment number of next series
↓ 2 [ENTER]	P2=2.00	ending payment number of next series
↓	<b>BAL=159,009.19</b>	balance after payment 2
↓	<b>PRN= -496.90</b>	principal, payment 2
↓	<b>INT= -963.68</b>	interest, payment 2

*Note:* Don't clear calculator; the next example is a continuation.

### Example 2 of Unit 19.1

Refer to Example 1 (above). Calculate interest, principal, and remaining balance for each of the first 3 *calendar years*.

*Note:* Tara got her loan on April 1, so she makes 8 payments the first calendar year. So the first calendar year, we will slice out payments 1-8; for the second calendar year, we will slice out payments 9-20; and for the third calendar year, we will slice out payments 21-32.

<u>keystrokes (continued from Example 1)</u>	<u>display</u>	<u>explanation</u>
↓	P1=2.00	asking for payment 1 of the series of payments
1 [ENTER]	P1=1.00	beginning payment number for payments 1-8
↓ 8 [ENTER]	P2=8.00	ending payment number
↓	BAL= <b>155,964.12</b>	balance after payment 8
↓	PRN= <b>-4,035.88</b>	principal, payments 1-8
↓	INT= <b>-7,648.76</b>	interest, payments 1-8
↓	P1=1.00	asking for beginning payment of next series
9 [ENTER]	P1=9.00	beginning payment number for payments 9-20
↓ 20 [ENTER]	P2=20.00	ending payment number for payments 9-20
↓	BAL= <b>149,533.66</b>	balance after payment 20
↓	PRN= <b>-6,430.46</b>	principal, payments 9-20
↓	INT= <b>-11,096.50</b>	interest, payments 9-20
↓	P1=9.00	asking for beginning payment of next series
[CPT]	P1=21.00	we used "CPT" key; see note below*
↓	P2=32.00	ending payment number of next series*
↓	BAL= <b>142,621.21</b>	balance after payment 32
↓	PRN= <b>-6,912.45</b>	principal, payments 21-32
↓	INT= <b>-10,614.51</b>	interest, payments 21-32

\**Note:* The series of payments for the second calendar year was for 12 payments. Because the third calendar year is also 12 payments, we can press [CPT] when keying in P1 value and P2 value; the calculator will automatically increase each value by 12. We could do the same thing for calendar year 4, 5, etc.

*Note:* Don't clear calculator; the next example is a continuation.

### Example 3 of Unit 19.1

Refer to Examples 1 and 2 (above). Calculate the total interest Tara will pay on her 15-year loan.

<u>keystrokes (continued from Example 2)</u>	<u>display</u>	<u>explanation</u>
↓	P1=21.00	asking for beginning payment number
1 [ENTER]	P1=1.00	beginning payment number
↓ 180 [ENTER]	P2=180.00	ending payment number
↓	BAL=0.33*	balance after 180 payments of \$1,460.58
↓	PRN= -159,999.67	principal, 180 payments of \$1,460.58
↓	INT= -102,904.73	interest for all 180 payments
[2nd] [QUIT]	0.00	back to standard calculator mode

*Note:* Because of rounding each payment to the nearest penny and because interest for each payment is rounded to the nearest penny, the balance after the final payment is rarely \$0.00. Tara's final payment must be 33¢ greater (\$1,460.91) so the loan will be fully repaid. Tara will make 179 monthly payments of \$1,460.58 and a final payment of \$1,460.91.

### Example 6 of Unit 19.2

(Condensed). Tara got a \$160,000 mortgage loan at 7.25%. Her total loan costs, for APR purposes, is \$8,060. Assume Tara will pay off the loan at the end of 7 years. Calculate her real APR, reflecting the early payoff.

<u>keystrokes</u>	<u>display</u>	<u>explanation</u>
<i>calculate monthly payment</i>		
15 [×] 12 [=] [N]	180.00	180 months
7.25 [÷] 12 [=] [I/y]	0.60	periodic rate = 0.60
160,000 [PV]	160,000.00	loan amount
0 [FV]	0.00	there is no future value
[CPT] [PMT]	-1,460.58	monthly payment
<i>calculate balance after payment 84 (must have decimal at 2)</i>		
[2nd] [AMORT]	P1=1.00	asking for beginning payment number; okay at 1
↓ 84 [ENTER]	P2=84.00	ending payment number
↓	106,158.81	balance after payment 84
[STO] 1	106,158.81	amount stored
<i>calculate APR (loan paid off in 7 years)</i>		
[2nd] [QUIT]	0.00	back to standard calculator mode
7 [×] 12 [=] [N]	84.00	number of periods Tara will have the loan
160,000 [-] 8,060 [=] [PV]	151,940.00	net proceeds
[RCL] 1 [+/-] [FV]	-106,158.81	unpaid balance entered in FV register as a negative value
[CPT] [I/y]	0.70	periodic (monthly) rate
[×] 12 [=]	<b>8.35</b>	APR, reflecting the early payoff

### Example 1 of Unit 19.5

Four years ago, you purchased some corporate stock for \$2,000. You received dividends as follows: \$100 at the end of year 1, \$150 at the end of year 2, nothing at the end of year 3, and \$125 at the end of year 4. Immediately after receiving the final dividend check, you sold the stock for \$2,700. What is your annual rate of return?

The keystrokes are identical to the keystrokes for the TI BAI PLUS shown in the text, except to clear the worksheet, press [2nd] [CLEAR] instead of [2nd] [CLR WORK].

### Example 3 of Unit 19.5

(Condensed). Florence Curtis decides to sell her office supply business. Michael Gabriel offers to buy the business by paying \$2,000 at the end of each month for 10 years, followed by \$3,000 at the end of each month for 5 years. Assuming that money is worth 8.5% compounded monthly (that is the rate that Florence can earn on her money), what is the present value of Michael's offer?

The keystrokes are identical to the keystrokes for the TI BAI PLUS shown in the text, except to clear the worksheet, press [2nd] [CLEAR] instead of [2nd] [CLR WORK].