Texas Instruments BAII PLUS Tutorial

To begin, look at the face of the calculator. Almost every key on the BAII PLUS has two functions: each key's primary function is noted on the key itself, while each key's secondary function is noted in white above the key. To use the function on the key, simply press the key. To access the white function above each key, first press the gray key with "2nd" printed on it, which we will call the "2nd shift" key, and then press the desired function key. (Note that the 2nd shift key is near the upper left corner of the calculator keyboard.)

Turning the Calculator On and Off

To turn on the calculator, press ⌊ON/OFF⌋. To turn off the calculator, press ⌊ON/OFF⌋.

Note that the "ON/OFF" key is on the upper right corner of the keyboard. Also, we will designate keys throughout this tutorial by the use of small boxes, as above. To conserve the battery, the calculator turns itself off about 10 minutes after your last keystroke.

Also, note that pressing the 2nd shift key places a little "2nd" symbol in the upper left corner of the display. Press the 2nd shift key again and the symbol goes away. The ⌊2nd⌋ key is a toggle key that switches back and forth between the "regular" and the "2nd" functions. ⌊2nd⌋ is like the typewriter shift key. After you press ⌊2nd⌋, look only at the white writing above the keys.

Note that the calculator has a continuous memory, so turning it off does not affect any data stored in the calculator, but it will erase any number showing on the screen.

Clearing the Calculator

Five of the most commonly used methods of clearing data are presented below:

⌊2nd⌋ ⌊MEM⌋ ⌊2nd⌋ ⌊CLR WORK⌋ clears all 10 memory locations and the display.

⌊2nd⌋ ⌊QUIT⌋ ⌊2nd⌋ ⌊CLR TVM⌋ clears the TVM worksheet.

⌊2nd⌋ ⌊CLR WORK⌋ clears worksheets other than the TVM worksheet.

⌊CE/C⌋ clears the entire display, but not the memory.

⌊○⌋ clears numbers on the display one at a time if you made a mistake entering data.

Review your owner's manual for other methods of clearing information.

Clearing the calculator is very important, since unwanted data in memory can result in improper calculations, and hence wrong answers. It is best to get into the habit of automatically clearing memory before starting a calculation. Occasionally, you may purposely want to save data, but, in general, you will be entering all new data, so starting with a clear memory is the safest approach.

Changing the Display

To change decimals from 2 to 4, press [2nd] [FORMAT] [4] [ENTER] [2nd] [QUIT]. 0.0000 is displayed.

To change from 4 places to 2, press [2nd] [FORMAT] [2] [ENTER] [2nd] [QUIT]. 0.00 is displayed.

We usually set the display to 2 places, which is especially convenient when working with dollars and percentages. However, we often use 4 places when dealing with interest rates and rates of return that are entered as decimals.

Periods per Year Setting

One important setting that can cause problems is the periods per year setting. To check the current setting, press [2nd] [P/Y]. The display shows the setting for periods/year. The calculator comes pre-set at 12 periods per year, that is, it assumes calculations will be done on a monthly basis. However, finance textbook problems generally use 1 period/year. To change to 1/year:

Press [2nd] [P/Y] 1 [ENTER] [2nd] [QUIT].

Now the calculator is set to assume 1 period/year. To confirm this setting, press [2nd] [P/Y] [2nd] [QUIT]. Unless needed for other work, we generally leave the calculator setting at 1 period per year.

Time Value of Money (TVM)

The TVM keys are located on the third row from the top of the keyboard.

[N] [I/Y] [PV] [PMT] [FV]

In general, TVM problems involve four variables—three are known and the fourth is unknown.

Lump Sums

To begin, we consider TVM calculations with single (lump) sums. In this situation, we do not use the PMT key, so be sure to either press [2nd] [CLR TVM], which sets the payment (PMT) equal to 0, or enter 0 as the PMT when entering the input data. If you know any three variables, you can find the value of the fourth.

Example 1:

What is the FV of $100 after 3 years if the interest rate is 26 percent? First, clear with [2nd] [CLR TVM].

Next, enter the data.

$$3 \quad [\text{N}]$$

$$26 \quad [\text{I/Y}]$$

$$100 \quad [\text{PV}]$$

$$0 \quad [\text{PMT}] \quad \text{(Optional if registers are cleared.)}$$

To determine the FV simply press [CPT] [FV] and the FV of -$200.04 is displayed.

The BAII PLUS is programmed so that if the PV is + then the FV is displayed as - and vice versa, because the BAII PLUS assumes that one is an inflow and the other is an outflow. When entering both PV and FV, one must be entered as negative and the other as positive.

Example 2:

What is the PV of $500 due in 5 years if the interest rate is 10 percent? Clear first and then enter the following data.

$$5 \quad [\text{N}]$$

$$10 \quad [\text{I/Y}]$$

$$0 \quad [\text{PMT}] \quad \text{(Optional if registers are cleared.)}$$

$$500 \quad [\text{FV}]$$

Pressing the [CPT] [PV] key reveals that $310.46 will grow to $500 in 5 years at a 10 percent rate.

Example 3:

Assume a bond can be purchased today for $200. It will return $1,000 after 14 years. The bond pays no interest during its life. What rate of return would you earn if you bought the bond?

14　N

200　+/-　PV　　(The +/- key changes the sign.)

0　PMT

1000　FV

Simply press the CPT I/Y key and the BAII PLUS calculates the rate of return to be 12.18%.

Remember that the BAII PLUS is programmed so that if the PV is + then the FV is displayed as - and vice versa because the BAII PLUS assumes that one is an inflow and the other is an outflow.

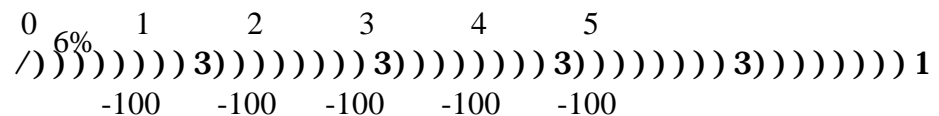Now suppose you learn that the bond will actually cost $300. What rate of return will you earn?

Override the -200 by entering 300 +/- PV , then press CPT I/Y to get 8.98 percent. If you pay more for the bond, you earn less on it. The important thing, though, is that you can do "what if" analyses with the calculator.

Now do nothing except press ON/OFF to turn off the calculator. Then turn on the calculator ON/OFF . The display shows 0.00. Is the memory erased? Not completely. What was on the screen is gone, but press RCL N to get N = 14.

Ordinary Annuities

Example 1:

What is the FV of an annuity of $100 paid at the end of each year for 5 years if the interest rate equals 6 percent?

```
 0  6%    1       2       3       4       5
/)))))))) 3))))))) 3))))))) 3))))))) 3))))))) 1
          -100    -100    -100    -100    -100
```

5   [N]

6   [I/Y]

0   [PV]

100 [+/-] [PMT]

Now press the [CPT] [FV] key, and an FV of $563.71 is displayed.

Example 2:

What is the PV of the same annuity?

Leave data in calculator, but enter 0 as the FV to override, then press [CPT] [PV] to get $421.24.

Annuities Due

Each payment of an annuity due occurs at the beginning of the period instead of at the end as with a regular annuity. In essence, each payment is shifted back one period. To analyze annuities due press [2nd] [BGN] [2nd] [SET] [CE/C]. "BGN" appears on the screen and in the upper right corner of the display. Now the BAII PLUS analyzes the cash flows based on beginning of period payments. Change back to end mode by pressing [2nd] [BGN] [2nd] [SET] [CE/C].

Interest Conversion

The following equation is used to convert a nominal rate to an effective rate.

$$EAR = \left[1 + \frac{k_{Nom}}{m}\right]^m - 1.$$

Given: k_{Nom} = 10% and m = 12 payments/year,

$$EAR = \left[1 + \frac{0.10}{12}\right]^m - 1 = (1.0083)^{12} - 1 = 1.1047 - 1 = 0.1047 = 10.47\%.$$

However, it's much easier to convert the nominal rate using the calculator.

First, we need to set the calculator to 12 payments per year:

| 2nd | | I CONV | | € | 12 | ENTER |

| • | 10 | ENTER |

| • | CPT |

The effective rate of 10.47 percent is displayed on the screen.

Cash Flow Operations

Example 1: Uneven Cash Flows

We can also find the PV, FV, and IRR (internal rate of return) of a series of unequal cash flows.

Assume the following cash flows:

```
   0  10%   1        2        3        4
  /))))))))) 3))))))))) 3))))))))) 3))))))))) 1
   0      50      100      150      200
```

What is the PV of these CFs?

First clear the BAII PLUS and make sure that periods/year is set equal to 1.

Enter the cash flow worksheet by pressing [CF] then clear any previous cash flow analyses, [2nd] [CLR WORK] . Next, enter the cash flows:

0	ENTER	•	Sets CF_0 equal to 0 and moves to CF_1.
50	ENTER	•	Sets CF_1 equal to 50 and moves to frequency of occurrence of CF_1.
1	ENTER	•	Tells calculator that the $50 CF occurs only once.
100	ENTER	•	
1	ENTER	•	
150	ENTER	•	
1	ENTER	•	
200	ENTER	•	
1	ENTER		

The CFs from the time line are entered. Now enter the interest rate.

NPV 10 ENTER •

At this point the BAII PLUS knows the cash flows, the number of periods, and the interest rate. To find the PV, press CPT to get PV = NPV = $377.40.

Example 2: Embedded Annuities

We have these cash flows, which contain embedded annuities:

0	1	2	3	4	5	6	7	8	9
10%									

/)))))))3))))))3))))))3))))))3))))))3))))))3))))))3))))))3))))))1

0	100	100	100	200	200	300	300	300	300

What's the PV?

Clear, set P/YR = 1 if changed.

First enter the cash flow worksheet by pressing CF then clear any previous cash flow analyses, 2nd CLR WORK . Next, enter the cash flows:

0 ENTER • Sets CF_0 equal to 0 and moves to CF_1.

100 ENTER • Sets CF_1 equal to 100 and moves to frequency of occurrence of CF_1.

3 ENTER • Tells calculator that the \$100 CF occurs three consecutive times.

200 ENTER •

2 ENTER •

300 ENTER •

4 ENTER

Now the BAII PLUS knows the cash flows. Thus, enter the interest rate:

NPV 10 ENTER • .

At this point the BAII PLUS knows the cash flows, the number of periods, and the interest rate. To find the PV, press CPT to get PV = NPV = \$1,099.94.

To check your entries:

CF then use the up and down arrow keys to view each cash flow.

Example 3: The Rate of Return Offered by an Investment (IRR)[1]

Assume that we invest $1,000 now $(t = 0)$ and then expect to receive an uneven set of cash flows. Here is the CF time line:

```
       0        1        2        3        4
      /))))))))3))))))))3))))))))3))))))))1
    -1000     300      400      200      600
```

What rate of return will we earn?

First enter the cash flow worksheet by pressing $\boxed{\text{CF}}$ then clear any previous cash flow analyses, $\boxed{\text{2nd}}$ $\boxed{\text{CLR WORK}}$. Next, enter the cash flows:

1000	$\boxed{\text{+/-}}$ $\boxed{\text{ENTER}}$ $\boxed{\bullet}$	Sets CF_0 equal to -1,000 and moves to CF_1.
300	$\boxed{\text{ENTER}}$ $\boxed{\bullet}$ $\boxed{\bullet}$	Sets CF_1 equal to -1000 and moves to frequency of occurrence of CF_1. The second $\boxed{\bullet}$ tells calculator that the $300 CF occurs only once.[2]
400	$\boxed{\text{ENTER}}$ $\boxed{\bullet}$ $\boxed{\bullet}$	
200	$\boxed{\text{ENTER}}$ $\boxed{\bullet}$ $\boxed{\bullet}$	
600	$\boxed{\text{ENTER}}$ $\boxed{\bullet}$ $\boxed{\bullet}$	

Now the BAII PLUS knows the cash flows. Thus, simply press $\boxed{\text{IRR}}$ $\boxed{\text{CPT}}$ and the IRR of 16.71 percent is displayed.

---

[1] If a negative CF occurs at the end of a project's life, or if a sequence of cash flows has two or more sign changes, there may be multiple IRR solutions. The calculator displays the IRR closest to zero. However, the displayed solution has no financial meaning. Thus, you should use caution in making investment decisions based on an IRR computed for a cash flow stream with more than one sign change. When you are solving very complex cash flow problems, the calculator may not be able to find IRR, even if a solution exists. When this is the case, the calculator displays *Error 7* (iteration limit exceeded).

[2] If you do not enter a value for frequency after you enter the cash flow value, the calculator assumes a value of 1; however, the down arrow key must be pressed again before entering the next cash flow.

You can also determine the NPV of the investment. Leave data entered and then enter the opportunity cost interest rate, say 8 percent. To find NPV press

| I/YR | 8 | ENTER | • | CPT |

The NPV of $220.50 is displayed. Thus, the PV of the cash inflows exceeds the cost of the investment by $220.50.

Statistical Calculations

The BAII PLUS can also be used for several types of statistical calculations.

Mean and Standard Deviation (F)

Year	Sales
1994	$150
1995	95
1996	260

What's the mean (average) and standard deviation (F) of sales over the 3 years?

First select the data-entry portion of the statistics worksheet by pressing | 2nd | DATA | then clear any previous data entries, | 2nd | CLR WORK |. Next, enter the data:

150 | ENTER | • | • | This enters 150 as the data entry and tells the calculator there is no Y-variable associated with the X variable.

95 | ENTER | • | • | This enters 95 as the second data entry and tells the calculator there is no Y-variable associated with the X variable.

260 | ENTER | • | • | This enters 260 as the third data entry and tells the calculator there is no Y-variable associated with the X variable.

Now select the statistical calculation portion of the statistics worksheet by pressing | 2nd | STAT | then clear any previous statistical entries, | 2nd | CLR WORK |.

"LIN" should now be displayed on the screen. Keep pressing $\boxed{\text{2nd}}$ then $\boxed{\text{SET}}$ until "1-V" (one variable calculation method) is displayed. Press the down arrow key three times to view (1) sample size, n, (2) mean, $\overline{x}$, and (3) standard deviation, Sx. The mean equals \$168.33. The standard deviation is \$84.01.

Linear Regression

Beta coefficients can be calculated by using the BAII PLUS's linear regression capabilities. The X (independent variable) and Y (dependent variable) values must be entered in the proper sequence, where the X data is on the horizontal axis (**market**) and Y data is on the vertical axis (**stock**).

Year	Market (k_m)	Stock (k_j)
1	23.8%	38.6%
2	-7.2	-24.7
3	6.6	12.3
4	20.5	8.2
5	30.6	40.1

First select the data-entry portion of the statistics worksheet by pressing $\boxed{\text{2nd}}$ $\boxed{\text{DATA}}$ then clear any previous statistical entries, $\boxed{\text{2nd}}$ $\boxed{\text{CLR WORK}}$.

Next, enter the data as follows:

23.8 $\boxed{\text{ENTER}}$ $\boxed{\bullet}$ This enters 23.8 as the first X variable.

38.6 $\boxed{\text{ENTER}}$ $\boxed{\bullet}$ This enters 38.6 as the first Y variable.

7.2 $\boxed{\text{+/-}}$ $\boxed{\text{ENTER}}$ $\boxed{\bullet}$ This enters -7.2 as the second X variable.

24.7 $\boxed{\text{+/-}}$ $\boxed{\text{ENTER}}$ $\boxed{\bullet}$ This enters -24.7 as the second Y variable.

6.6 $\boxed{\text{ENTER}}$ $\boxed{\bullet}$ This enters 6.6 as the third X variable.

12.3 $\boxed{\text{ENTER}}$ $\boxed{\bullet}$ This enters 12.3 as the third Y variable.

20.5 $\boxed{\text{ENTER}}$ $\boxed{\bullet}$ This enters 20.5 as the fourth X variable.

8.2 $\boxed{\text{ENTER}}$ $\boxed{\bullet}$ This enters 8.2 as the fourth Y variable.

30.6 $\boxed{\text{ENTER}}$ $\boxed{\bullet}$ This enters 30.6 as the fifth X variable.

40.1 $\boxed{\text{ENTER}}$ $\boxed{\bullet}$ This enters 40.1 as the fifth Y variable.

Now select the statistical calculation portion of the statistics worksheet by pressing $\boxed{\text{2nd}}$ $\boxed{\text{STAT}}$ then clear any previous statistical entries, $\boxed{\text{2nd}}$ $\boxed{\text{CLR WORK}}$.

"LIN" should now be displayed on the screen. Keep pressing $\boxed{\textbf{9}}$ until "a =" appears on the screen. This is the value of the y-intercept of the regression line. Press $\boxed{\textbf{9}}$ one more time and "b =" appears one the screen. This is the value of the slope of the regression line. If you press $\boxed{\textbf{9}}$ one more time, "r =" appears on the screen. This is the value of the correlation coefficient of the regression line. (The intercept value is -8.92, the slope value is 1.60, and the correlation coefficient is 0.91.)

Clear the calculator by pressing $\boxed{\text{2nd}}$ $\boxed{\text{DATA}}$ $\boxed{\text{2nd}}$ $\boxed{\text{CLR WORK}}$.

Amortization

The BAII PLUS can also be used to calculate amortization schedules. First, clear the TVM registers by pressing $\boxed{\text{2nd}}$ $\boxed{\text{QUIT}}$ $\boxed{\text{2nd}}$ $\boxed{\text{CLR TVM}}$.

Example:

Determine the interest and principal paid each year and the balance at the end of each year on a three-year $1,000 amortizing loan which carries an interest rate of 10 percent. The payments are due annually.

First, check payments/year and be sure it's 1. ($\boxed{\text{2nd}}$ $\boxed{\text{P/Y}}$ $\boxed{\text{2nd}}$ $\boxed{\text{QUIT}}$)

Now perform the following steps:

3 $\boxed{\text{N}}$

10 $\boxed{\text{I/Y}}$

1000 $\boxed{\text{PV}}$

$\boxed{\text{CPT}}$ $\boxed{\text{PMT}}$ A payment of -402.11 is displayed.

Now we will use the amortization worksheet to generate an amortization schedule for the loan:

| 2nd | AMORT | 2nd | CLR WORK | Enters the Amort worksheet and clears any old contents.

| • | 1 | ENTER | Ending period set at 1 because we want to view the amortization information for each and every payment.

Now just use the down arrow key to view the balance after the payment as well as the interest and principal portions of the first payment.

To view the results for the second payment, press | • | to move to "P1," press | CPT | and use the down arrow key to view the ending balance after the payment is made as well as the interest and principal portions of the second payment.

Repeat for the third and last payment.

This is the amortization schedule corresponding to the loan.

	Beg. Bal.	Payment	Interest	Princ. Repmt.	Ending Bal.
1	1,000.00	402.11	100.00	302.11	697.89
2	697.89	402.11	69.79	332.32	365.57
3	365.57	402.11	36.56	365.55	.02