

# Using Financial and Business Calculators

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# Using Financial and Business Calculators

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Most business and financial calculators offer a multitude of powerful functions. The purpose of this guide is to provide students with an easy and quick reference for some of the most commonly used financial functions. More detailed operational descriptions can be obtained from the owner's manuals that accompany the calculators.

This calculator guide discusses the basic functions of five business and financial calculators: the Texas Instruments (TI) BA-35 SOLAR, the Texas Instruments (TI) BA II PLUS, the Hewlett-Packard (HP) 12C, the Hewlett-Packard (HP) 17BII, and the Hewlett-Packard (HP) 19BII. The sections for each calculator present step-by-step instructions for using general and financial functions offered by each calculator. The calculations for each type of financial operation have been explained using sample problems. The display on the calculator's screen at the completion of each step has also been included to allow you to confirm your calculations as you proceed.



# Texas Instruments (TI) BA-35 Solar







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The TI BA-35 SOLAR can operate in three different modes: statistical (STAT), financial (FIN), and profit margin. No indicator is displayed for the profit margin mode. To set the calculator to a particular mode, press **MODE** repeatedly until the appropriate indicator is displayed. Changing to a new mode clears the contents of the mode registers. Arithmetic, mathematical, and percentage operations can be executed in any of the three modes.

The second function (**2nd**) invokes the “second” functions that are marked above some of the keys. To perform a second function, press **2nd** and then the appropriate function key. If you accidentally press the **2nd** key, simply press it again to cancel its effect.




















## A. Clearing the calculator display and memory, and setting the decimal points:

Keystrokes	Display	Description
1. <b>AC/ON</b>	0	Switches the calculator on. This will also clear the calculator completely, including the display, all pending operations, and the memory and mode operations. It also sets the calculator to floating-decimal mode and financial mode.
2. <b>CE/C</b>	0	Clears incorrect entries, error conditions, the display, or pending operations. It does not affect the memory, the mode registers, or the display format.
3. <b>2nd</b> <b>CMR</b>	0	Clears any values that have been stored in the mode registers. Changing to a new mode also clears the contents of the mode registers.

4.	  	0.00	Sets the number of decimals to two.
5.	  	0	Sets decimals back to floating.

**B. Calculating the present value of a lump sum amount:**

**Example:** Liz anticipates it will cost her \$65,000 to buy a house in 18 months. How much should she invest today at an annual interest rate of 15% (interest is compounded monthly) to be able to afford the house in one and a half years?

Keystrokes	Display	Description
Clear all memory.		
1. 	0	Clears Time-Value-of-Money worksheet.
2.      	65,000	Records the future cash flow of \$65,000.
3.   	18	Calculates the number of time periods as 18.
4.       	1.25	Records the periodic interest rate of 1.25% per month for 18 months.
5.  	51,975.99	Calculates the present value of \$65,000 in 1.5 years discounted at a monthly rate of 1.25%.

**C. Calculating the future value of a lump sum amount:**

**Example:** If John invests \$1,850 today in an asset earning a 10% rate of return (compounded annually), how much will he have after two years?



Keystrokes	Display	Description
Clear all memory.		
1. <b>AC/ON</b>	0	Clears Time-Value-of-Money worksheet.
2. <b>1 8 5 0 PV</b>	1,850	Records the present cash outflow of \$1,850.
3. <b>1 0 %i</b>	10	Stores annual rate of interest as 10%.
4. <b>2 N</b>	2	Records number of time periods as 2.
5. <b>CPT FV</b>	2,238.50	Calculates the future value of \$1,850 after 2 years at 10%.

#### D. Calculating the present value of an annuity:

**Example:** How much should you invest now so that starting one year from today your daughter can receive \$6,000 per year for the next five years? Assume the discount rate is 15%.







Keystrokes	Display	Description
Clear all memory.		
1. <b>AC/ON</b>	0	Clears Time-Value-of-Money worksheet.
2. <b>6 0 0 0 PMT</b>	6,000	Records the amount of the periodic payments or annuity.
3. <b>1 5 %i</b>	15	Records annual rate of interest as 15%.
4. <b>5 N</b>	5	Records number of time periods as 5.
5. <b>CPT PV</b>	PV = 20,112.93	Calculates the PV of the annuity.

E. Calculating the present value of an annuity due:
















**Example:** In this case, instead of receiving payments at the end of each year, your daughter will receive the payments at the beginning of each year. Therefore, her first payment will be received immediately.

There are two methods to calculate the present value of an annuity due:

- 1. *You can calculate the present value of an annuity, as shown in Section D, and multiply it by  $(1 + k)$ . In that case the additional step would be:*

Keystrokes	Display	Description
Follow steps 1–5 from Section D.		
6.      	23,129.87	Calculates the PV of the annuity due.

- 2. *The TI BA-35 SOLAR allows you to set the timing of the payment. You have to set the payment mode at “BEGIN” and start from the first step. This method is shown below:*

Keystrokes	Display	Description
Clear all memory.		
1. 	0	Clears Time-Value-of-Money worksheet.
2.  	Begin	Sets the payment mode to beginning of the period.
3.     	6,000	Records the amount of the periodic payments.
4.   	15	Records annual rate of interest as 15%.
5.  	5	Records number of time periods as 5.
6.  	23,129.87	Calculates the PV of the annuity due.

7.

AC/ON

0

Clears Time-Value-of-Money worksheet and sets payments to the default “end of the period” position.

F. Calculating the future value of an annuity:

**Example:** You have recently won a lottery for \$10,000. Your winnings will come in five annual payments of \$2,000 each starting one year from now. If the annual compound rate is 11.4%, how much is the lottery worth at the end of five years?








Keystrokes	Display	Description
Clear all memory.		
1. <div>AC/ON</div>	0	Clears Time-Value-of-Money worksheet.
2. <div>2000PMT</div>	2,000	Records the amount of periodic payments.
3. <div>11.4%i</div>	11.4	Records the annual compound rate as 11.4%.
4. <div>5N</div>	5	Records the number of time periods as 5.
5. <div>CPTFV</div>	-12,555.07	Calculates FV of the annuity.



















G. Calculating the future value of an annuity due:

**Example:** In this case, your winnings will be paid at the beginning, instead of at the end, of each year for five years. So you are going to get the first payment of your \$10,000 lottery, i.e. \$2,000, immediately. There are two methods to calculate the future value of an annuity due:

1.

*You can calculate the future value of an annuity, as shown in Section F, and multiply it by (1 + k). In that case the additional step would be:*

Keystrokes	Display	Description
Follow steps 1–5 from Section F. (i)		
6.       	-13,986.35	Calculates the FV of the annuity due.
2. <i>The TI BA-35 SOLAR allows you to set the timing of the payment. You have to set the payment mode at “BEGIN” and start from the first step. This method is shown below.</i>		

Keystrokes	Display	Description
Clear all memory.		
1. 	0	Clears Time-Value-of-Money worksheet.
2.  	Begin	Sets the payment mode to the beginning of the period.
3.     	2,000	Records the amount of the periodic payments.
4.     	11.4	Records annual rate of interest as 11.4%.
5.  	5	Records number of time periods as 5.
6.  	-13,986.35	Calculates the FV of the annuity due.
7. 	0	Clears Time-Value-of-Money worksheet and sets payments to the default “end of the period” position.

**H. Calculating the net present value of an annuity:**

**Example:** Jane thinks if she invests \$80,000 by buying property today, she can get \$15,000 in rent from it for each of the next 20 years (the rent will be paid quarterly). If she wants a rate of return of 12% (with quarterly discounting) on her investment, what is the net present value of this project?

- 1. The annual rate of return will be divided by four, i.e., the quarterly rate of return will be 3%.
- 2. The number of time periods will be multiplied by four, i.e., 80.
- 3. The amount of annual rent will be divided by four, i.e., \$3,750.

Keystrokes	Display	Description
Clear all memory.		
1. AC/ON	0	Clears Time-Value-of-Money worksheet.
2. 1 5 0 0 0 ÷ 4 = PMT	3,750	Records the amount of the quarterly periodic payments.
3. 1 2 ÷ 4 = %i	3	Records quarterly rate of interest as 3%.
4. 2 0 × 4 = N	80	Records number of quarterly time periods as 80.
5. CPT PV	113,252.86	Calculates the PV of the annuity.
6. - 8 0 0 0 0 0 =	33,252.86	Computes the Net Present Value.

I. Calculating the internal rate of return of an annuity:

**Example:** ABC Inc. is planning to spend \$35,000 to buy a warehouse. Under the contract they will receive an annual after-tax cash flow of \$6,000 (paid semiannually) from the property for the next eight years. What is the internal rate of return for the investment?

Keystrokes	Display	Description
Clear all memory.		
1. AC/ON	0	Clears Time-Value-of-Money worksheet.
2. 6 0 0 0 ÷ 2 = PMT	3,000	Records the amount of the semiannual periodic payments.
3. 3 5 0 0 0 PV	35,000	Records the cost of the warehouse.
4. 8 × 2 = N	16	Records number of quarterly time periods as 80.
5. CPT %i	3.98	Calculates semiannual IRR.
6. × 2 =	7.97	Computes the IRR.

J. Bond valuation with interest compounded annually:

**Example:** How much would you be willing to pay for a bond today if it pays \$100 in interest annually for 20 years (starting next year) and has a principal payment of \$1,000? The yield to maturity is 15%.

This question can be interpreted as that of finding the NPV of an uneven cash flow series with the initial cash outflow equal to zero. Hence, we will follow the steps used for calculating NPV to compute the current price of the bond.

Keystrokes	Display	Description
Clear all memory.		
1. AC/ON	0	Clears Time-Value-of-Money worksheet.
2. 1 0 0 PMT	100	Records the amount of the periodic annual coupon payments.

3.	1 5 %i	15	Records annual yield-to-maturity as 15%.
4.	2 0 N	20	Records number of time periods as 20.
5.	1 0 0 0 FV	1000	Records the future face or par value of the bond.
6.	CPT PV	687.03	Calculates the bond's current market price.

### K. Bond valuation with interest compounded semiannually:

Because most bonds pay interest semiannually, we will show the conversion required to calculate the current value of such bonds.

**Example:** If the bond described in Section J pays interest semiannually, the calculations will be:

$$I_t = \$50, P_n = \$1000, i = 7.5\%, n = 40.$$

Keystrokes	Display	Description
Clear all memory.		
1. AC/ON	0	Clears Time-Value-of-Money worksheet.
2. 1 0 0 ÷ 2 = PMT	50	Records the amount of the periodic semiannual coupon payments.
3. 1 5 ÷ 2 = %i	7.5	Records semiannual yield-to-maturity as 7.5%.
4. 2 0 × 2 = N	40	Records number of time periods as 40.
5. 1 0 0 0 FV	1000	Records the future face or par value of the bond.
6. CPT PV	685.13	Calculates the bond's current market price.





# Texas Instruments (TI) BA II PLUS








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The TI BAI PLUS can perform two basic sets of financial functions. The first set of functions is invoked simply by pressing the relevant keys. The second set is invoked first by pressing the gray or yellow colored 2nd function key (depending on which calculator you are using), which is located at the far left on the second row from the top, and then selecting the appropriate gray colored function written above the calculator keys.






This 2nd key will be represented by  in this chapter.

The BA II PLUS has a continuous memory. Turning off the calculator does not affect the contents stored in the memory, though the display is reset to zero. Therefore, it is extremely important to clear the calculator memory after each calculation. The BAI PLUS automatically turns itself off when not used for more than approximately ten minutes.





## A. Clearing the calculator display and memory, and setting the decimal points:

Keystrokes	Display	Description
1. 	0.00	Switch the calculator on.
2.  QUIT	0.00	Resets the calculator to the standard mode, and clears the screen.
3.  MEM  CLRWork	MO=0.00	Clears all the memory locations simultaneously.
4.  Format  ENTER	DEC=9	Allows the number of decimal places on the calculator to “float.”
5.  QUIT	0.00	Brings the calculator to the standard mode.

To clear each memory location individually, use the following key sequence.















Keystrokes	Display	Description
1.   1.	MO=0	Clears the memory location
2.    tion.	M9=0	Clears the next memory loca-

















A worksheet for this calculator is a framework of formulae, such as the Time-Value-of-Money worksheet. The term “worksheet” has been used extensively in the owner’s manual and, hence, is being used in this book.

- Note:
- 1. We will be using two decimal places for all the calculations in this appendix. To reset the TI BA II PLUS to two decimal places, press    .
  - 2. Even though it displays two decimal digits, the TI BAI PLUS uses 13 digits in all calculations.
  - 3. To erase a part of the entered display, use the CE/C key.
  - 4. The CE/C key can be used to clear any error displays.

**B. Using the memory capability:**
















**Example:** Before leaving on a sales call one morning, Alfred stored the price of a fax machine (\$1,200) and a printer (\$1,000) in his calculator. Later that day, he sold three fax machines and four printers to a customer. He used his calculator to get the total amount due from this customer in the following way:












Keystrokes	Display	Description
Clear all memory.		
1.      	1,200.00	Stores the price of the fax machine in memory location 1.
2.      	1,000.00	Stores the price of the printer in memory location 2.
3. 		Turns the calculator off.
Later that day:		
4. 	0.00	After the sale, Alfred turns the calculator on.

5.	 	1,200.00	Recalls the cost of the fax to the display.
6.	  	3,600.00	Multiplies 1,200 by 3 to calculate the cost of the three fax machines.
7.	 	3,600.00	Stores the number in the memory location 3.
8.	 	1,000.00	Recalls the cost of the printer.
9.	  	4,000.00	Calculates cost of four printers.
10.	   	7,600.00	Recalls the cost of the fax machines to calculate the total amount for the sale.

**C. Calculating the present value of a lump sum amount:**

**Example:** Liz anticipates it will cost her \$65,000 to buy a house in 18 months. How much should she invest today at an annual interest rate of 15% (interest is compounded monthly) to be able to afford the house in one and a half years?






















Keystrokes	Display	Description
Clear all memory.		
1.  	0.00	Clears Time-Value-of-Money worksheet.
2.     	P/Y=12.00	Sets number of payments per year to 12.
3.  	0.00	Brings the calculator to the standard mode.
4.      	FV=65,000.00	Records the future cash flow of \$65,000.

5.	  	I/Y=15.00	Records the periodic rate of interest as 15%.
6.	    	18.00	Calculates the number of time periods as 18.
7.		N=18.00	Stores the number of time periods.
8.	 	PV=-51,975.99	Calculates the present value of \$65,000 in 1.5 years discounted at a monthly rate of 1.25%.

Note: The display in step 8 has a negative sign because it represents a cash outflow (investment) today.





















D . Calculating the future value of a lump sum amount:

**Example:** If John invests \$1,850 today in an asset earning a 10% rate of return (compounded annually), how much will he have after two years?

Keystrokes	Display	Description
Clear all memory.		
1.  	0.00	Clears Time-Value-of-Money worksheet.
2.    	P/Y=1.00	Sets number of payments per year to 1.
3.  	0.00	Brings the calculator to the standard mode.
4.      	PV=-1,850.00	Records the present cash outflow of \$1,850.
5.   	I/Y=10.00	Stores annual rate of interest as 10%.
6.  	N=2.00	Records number of time periods as 2.
7.  	FV=2,238.50	Calculates the future value of \$1,850 after two years at 10%.

**E. Calculating the present value of an annuity:**

**Example:** How much should you invest now so that starting one year from today your daughter can receive \$6,000 per year for the next five years? Assume the discount rate is 15%.







Keystrokes	Display	Description
Clear all memory.		
1.  	0.00	Clears Time-Value-of-Money worksheet.
2.    	P/Y=1.00	Sets number of payments per year to 1.
3.  	0.00	Brings the calculator to the standard mode.
4.     	PMT=6,000.00	Records the amount of the periodic payments.
5.   	I/Y=15.00	Records annual rate of interest as 15%.
6.  	N=5.00	Records number of time periods as 5.
7.  	PV=-20,112.93	Calculates the PV of the annuity.

**F. Calculating the present value of an annuity due:**





























**Example:** In this case, instead of receiving payments at the end of each year, your daughter will receive the payments at the beginning of each year. Therefore, her first payment will be received immediately.



There are two methods to calculate the present value of an annuity due:

1. *You can calculate the present value of an annuity, as shown in Section E, and multiply it by  $(1 + k)$ . In that case the additional step would be:*

Keystrokes	Display	Description
Follow steps 1–7 from Section E.		
8.      	-23,129.87	Calculates the PV of the annuity due.
























2. *The TI BAIL PLUS allows you to set the timing of the payment. You have to set the payment mode at “BEGIN” and start from the first step. This method is shown below:*

Keystrokes	Display	Description
Clear all memory.		
1.  	0.00	Clears Time-Value-of-Money worksheet.
2.    	P/Y=1.00	Sets number of payments per year to 1.
3.  	END	Shows the default setting for the payment mode.
4.  	BGN	Sets the payment mode to beginning of the period.
5.  	0.00	Brings the calculator to the standard mode.
6.     	PMT=6,000.00	Records the amount of the periodic payments.
7.   	I/Y=15.00	Records annual rate of interest as 15%.
8.  	N=5.00	Records number of time periods as 5.
9.  	PV=-23,129.87	Calculates the PV of the annuity due.
10.  	BGN	Invokes the payment mode.
11.  	END	Sets the payment mode to the end of the period.

12.  
- 0.00
- Brings the calculator to the standard mode.

G. Calculating the future value of an annuity:








**Example:** You have recently won a lottery for \$10,000. Your winnings will come in five annual payments of \$2,000 each starting one year from now. If the annual compound rate is 11.4%, how much is the lottery worth at the end of five years?

Keystrokes	Display	Description
Clear all memory.		
1.  	0.00	Clears Time-Value-of-Money worksheet.
2.    	P/Y=1.00	Sets number of payments per year to 1.
3.  	0.00	Brings the calculator to the standard mode.
4.     	PMT=2,000.00	Records the amount of periodic payments.
5.     	I/Y=11.40	Records the annual compound rate as 11.4%.
6.  	N=5.00	Records the number of time periods as 5.
7.   	12,555.07	Calculates FV of the annuity.


































H. Calculating the future value of an annuity due:

**Example:** In this case, your winnings will be paid at the beginning instead of at the end of each year for five years. So you are going to get the first payment of your \$10,000 lottery, i.e. \$2,000, immediately. There are two methods to calculate the future value of an annuity due:

1. *You can calculate the future value of an annuity, as shown in Section G, and multiply it by  $(1 + k)$ . In that case the additional step would be:*

Keystrokes	Display	Description
Follow steps 1–7 from Section G.		
8.       	13,986.35	Calculates the FV of the annuity due.

2. *The TI BAI PLUS allows you to set the timing of the payment. You have to set the payment mode at “BEGIN” and start from the first step. This method is shown below.*

Keystrokes	Display	Description
Clear all memory.		
1.  	0.00	Clears Time-Value-of-Money worksheet.
2.    	P/Y=1.00	Sets number of payments per year to 1.
3.  	END	Shows the default setting for the payment mode.
4.  	BGN	Sets the payment mode to the beginning of the period.
5.  	0.00	Brings the calculator to the standard mode.
6.     	PMT=2,000.00	Records the amount of the periodic payment.
7.     	I/Y=11.40	Records annual rate of interest as 11.4%.
8.  	N=5.00	Records number of time periods as 5.
9.   	13,986.35	Calculates the FV of an annuity due.
10.  	BGN	Invokes the payment mode.
11.  	END	Sets the payment mode to the end of the period.
12.  	0.00	Brings the calculator to the standard mode.



## I. Calculating the net present value of an annuity:

**Example:** Jane thinks if she invests \$80,000 by buying property today, she can get \$15,000 in rent from it for each of the next 20 years (the rent will be paid quarterly). If she wants a rate of return of 12% (with quarterly discounting) on her investment, what is the net present value of this project?

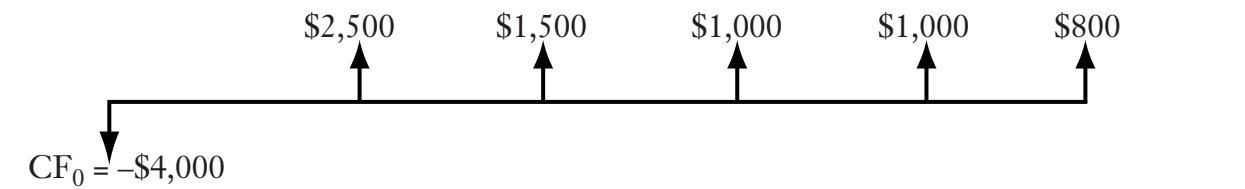
1. The annual rate of return will be divided by four, i.e., the quarterly rate of return will be 3%.
2. The number of time periods will be multiplied by four, i.e., 80.
3. The amount of annual rent will be divided by four, i.e., \$3,750.

Keystrokes	Display	Description
Clear all memory.		
1. <b>2nd</b> <b>CLRWork</b>	0.00	Clears the Cash Flow worksheet.
2. <b>2nd</b> <b>Reset</b> <b>ENTER</b>	RST 0.00	Resets all variables to zero.
3. <b>CF</b> <b>8</b> <b>0</b> <b>0</b> <b>0</b> <b>0</b> <b>+/-</b>	CF <sub>0</sub> -80,000	Inputs initial cash outflow.
4. <b>ENTER</b>	CF <sub>0</sub> =-80,000.00	Stores initial cash outflow.
5. <b>↓</b> <b>1</b> <b>5</b> <b>0</b> <b>0</b> <b>0</b> <b>÷</b>	C01 15,000.00	Calculates periodic cash inflows.
6. <b>4</b> <b>ENTER</b>	C01=3,750.00	Stores quarterly cash inflow amount.
7. <b>↓</b> <b>2</b> <b>0</b> <b>×</b> <b>4</b> <b>ENTER</b>	F01=80.00	Stores the number of times the quarterly cash inflow occurs.
8. <b>NPV</b> <b>1</b> <b>2</b> <b>÷</b> <b>4</b> <b>ENTER</b>	I=3.00	Stores the quarterly interest rate as 3%.
9. <b>↓</b> <b>CPT</b>	NPV=33,252.86	Calculates the net present value of the investment.

J. Calculating the net present value of a series of uneven cash flows:

















The TI BAII PLUS can store 24 cash flow groups besides the initial cash investment. A cash flow group comprises the cash flow amount and the number of times it repeats consecutive-ly in the cash flow series. Each cash flow group can have up to 9,999 cash flows i.e., the max-imum value of Fnn (the frequency of consecutive cash flows in one group) can be 9,999.

**Example:** Beth is planning to buy a Pentium-based PC for rental purposes. She has calculated that her expected cash flows from the investment for the next five years would be as shown below.





























If she has to pay an annual interest rate of 9.75%, should she buy the computer?

Keystrokes	Display	Description
Clear all memory.		
1. 2nd CLRWork	0.00	Clears the Cash Flow work-sheet.
2. 2nd Reset ENTER	RST 0.00	Resets all variables to zero.
3. CF 4 0 0 0 +/-	CF <sub>0</sub> -4,000	Inputs initial cash outflow.
4. ENTER	CF <sub>0</sub> =-4,000.00	Stores initial cash outflow.
5. ↓ 2 5 0 0 ENTER	C01=2,500.00	Stores the first cash inflow.
6. ↓	F01=1.00	Records that cash inflow of \$2,500 occurs once.
7. ↓ 1 5 0 0 ENTER	C02=1,500.00	Stores the second cash inflow.
8. ↓	F02=1.00	Records that cash inflow of \$1,500 occurs once.
9. ↓ 1 0 0 0 ENTER	C03=1,000.00	Stores the third cash inflow.

10.	  	F03=2.00	Stores the number of times that cash inflow of \$1,000 repeats.
11.	    	C04=800.00	Stores the fifth cash inflow.
12.	     	I=9.75	Stores the annual interest rate as 9.75%.
13.	 	NPV=1,471.37	Calculates the net present value of the investment.

### K. Calculating the internal rate of return of an annuity:

**Example:** ABC Inc. is planning to spend \$35,000 to buy a warehouse. Under the contract they will receive an after-tax cash flow of \$6,000 (paid semiannually) from the property for the next eight years. What is the internal rate of return for the investment?

Keystrokes	Display	Description
Clear all memory.		
1.  	0.00	Clears the Cash Flow worksheet.
2.   	RST 0.00	Resets all variables to zero.
3.       	C0 -35,000.00	Change sign to show cash outflow.
4. 	CF <sub>0</sub> =-35,000.00	Stores initial cash investment.
5.      	C01 6,000.00	Computes semi-annual cash inflow.
6.  	C01=3,000.00	Stores semi-annual cash inflow.
7.   	F01 8.00	Calculates the total number of time periods.
8.  	F01=16.00	Stores total number of time periods.

9. 

IRR

CPT

IRR=3.98

Calculates semi-annual IRR of this investment.
10. 

×

2

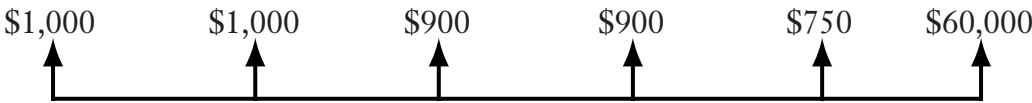
=

IRR 7.97

Calculates annual IRR of this investment.
















L. Calculating the internal rate of return of a series of uneven cash flows:

**Example:** Healthtime has the opportunity to make an investment that requires an initial cash outflow of \$6,500. The estimated cash inflows from the project for the next six years are shown below. What is the IRR on this investment?



$CF_0 = -\$6,500$




























Keystrokes	Display	Description
Clear all memory.		
1. <div>2nd</div> <div>CLRWork</div>	0.00	Clears the Cash Flow worksheet.
2. <div>2nd</div> <div>Reset</div> <div>ENTER</div>	RST 0.00	Resets all variables to zero.
3. <div>CF</div> <div>6</div> <div>5</div> <div>0</div> <div>0</div> <div>+/-</div>	CF <sub>0</sub> -6,500.00	Change sign to show cash outflow.
4. <div>ENTER</div>	CF <sub>0</sub> =-6,500.00	Stores initial cash investment.
5. <div>↓</div> <div>1</div> <div>0</div> <div>0</div> <div>0</div> <div>ENTER</div>	C01=1,000.00	Stores first cash inflow.
6. <div>↓</div> <div>2</div> <div>ENTER</div>	F01=2.00	Records that cash inflow of \$1,000 occurs twice
7. <div>↓</div> <div>9</div> <div>0</div> <div>0</div> <div>ENTER</div>	C02=900.00	Stores second cash flow amount.
8. <div>↓</div> <div>2</div> <div>ENTER</div>	F02=2.00	Records that cash inflow of \$900 occurs twice.


9.	    	C03=750.00	Stores third cash flow amount.
10.		F03=1.00	Shows that cash flow of \$750,000 occurs once.
11.	      	C04=60,000.00	Stores final cash inflow of \$60,000.
12.	 	IRR=51.88	Calculates IRR of this investment.

M. Bond valuation with interest compounded annually:

**Example:** How much would you be willing to pay for a bond today if it pays \$100 in interest annually for 20 years (starting next year) and has a principal payment of \$1,000? The yield to maturity is 15%.

This question can be interpreted as that of finding the NPV of an uneven cash flow series with the initial cash outflow equal to zero. Hence, we will follow the steps used for calculating NPV to compute the current price of the bond.

Keystrokes	Display	Description
Clear all memory.		
1.  	0.00	Clears the Cash Flow worksheet.
2.   	RST 0.00	Resets all variables to zero.
3.   	CF <sub>0</sub> =0.00	Inputs initial cash outflow as zero.
4.     	C01=100.00	Stores the first cash inflow.
5.    	F01=19.00	Records that cash inflow of \$100 occurs 19 times.
6.      	C02=1,100.00	Stores the final cash inflow.
7.    	I=15.00	Stores the annual discount rate as 15%.


































8. 
- NPV=687.03
- Calculates the initial price of the bond.

N. Bond valuation with interest compounded semiannually:

Because most bonds pay interest semiannually, we will show the conversion required to calculate the current value of such bonds.

**Example:** If the bond described in Section K pays interest semiannually, the calculations will be:

$I_t = \$50, P_n = \$1000, i = 7.5\%, n = 40.$

Keystrokes	Display	Description
Clear all memory.		
1.  	0.00	Clears the Cash Flow worksheet.
2.   	RST 0.00	Resets all variables to zero.
3.   	CF <sub>0</sub> =0.00	Inputs initial cash outflow as zero.
4.     	C01 100-00	Calculates the semiannual interest payment.
5.  	C01=50.00	Stores the semiannual interest payment as \$50.
6.    	F01 20.00	Calculates the number of periods when cash inflow of \$50 will occur.
7.    	F01=39.00	Stores the number of interest periods.
8.      	C02=1,050.00	Stores the final cash inflow.
9.    	I 15.00	Calculates semiannual discount rate.

10. 2 ENTER

$I=7.50$

Stores semiannual discount rate as 7.5%.

11. ↓ CPT

$NPV=685.14$

Calculates the initial price of the bond.











# Hewlett Packard (HP) 12C

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The HP 12C is color-coded. The gold “f” key refers to the function coded in gold above the keys on the calculator. Similarly, the blue “g” key refers to the functions coded in blue on the lower portion of the keys themselves.







The HP 12C has continuous memory. Therefore, turning of the calculator does not affect the information you have previously stored in the calculator. If not turned off manually, the calculator will turn off automatically approximately 8 to 17 minutes after last use.

## A. Clearing the calculator display and memory, and setting the decimal points:

Keystrokes	Display	Description
1.    REG	0.00000	Clears screen and storage registers.
2.  FIN	0.00000	Clears the financial registers.
3.  	0.00	Sets the number of decimal places equal to 2. Note: the HP12C will perform calculations to 10 decimals even though only two decimals are displayed.

## B. Using the memory capability:

**Example:** Before leaving on a sales call one morning, Alfred stored the price of a fax machine (\$1,200) and a printer (\$1,000) in his calculator. Later that day, he sold three fax machines and four printers to a customer. He used his calculator to get the total amount due from this customer in the following way:


Keystrokes	Display	Description
Clear all memory and financial registers.		
1.      	1,200.00	Stores the price of the fax machine in memory location 1.

2.	<b>1</b> <b>0</b> <b>0</b> <b>0</b> <b>STO</b> <b>2</b>	1,000.00	Stores the price of the printer in memory location 2.
3.	<b>ON</b>		Turns the calculator off.
Later that day:			
4.	<b>ON</b>	1,000.00	After the sale, Alfred turns the calculator on.
5.	<b>RCL</b> <b>1</b>	1,200.00	Recalls the cost of the fax to the display.
6.	<b>3</b> <b>×</b>	3,600.00	Multiplies 1,200 by 3 to calculate the cost of the three fax machines.
7.	<b>RCL</b> <b>2</b>	1,000.00	Recalls the cost of the printer.
8.	<b>4</b> <b>×</b>	4,000.00	Calculates cost of four printers.
9.	<b>+</b>	7,600.00	Totals the amount for this sale.

### C. Calculating the present value of a lump sum amount:

**Example:** Liz anticipates it will cost her \$65,000 to buy a house in 18 months. How much should she invest today at an annual interest rate of 15% (interest is compounded monthly) to be able to afford the house in one and a half years?













Keystrokes	Display	Description
Clear the memory and financial registers.		
1. <b>6</b> <b>5</b> <b>0</b> <b>0</b> <b>0</b> <b>FV</b>	65,000.00	Records the future cash flow of \$65,000.
2. <b>1</b> <b>5</b> <b>9</b> <b>12</b> <b>÷</b>	1.25	Records the monthly interest rate of 1.25%.
3. <b>1</b> <b>.</b> <b>5</b> <b>9</b> <b>12</b> <b>×</b>	18.00	Records the number of time periods as 18.

4.		-51,975.99	Calculates the present value of \$65,000 in 1.5 years discounted at a monthly rate of 1.25%.
----	-----------------------------------------------------------------------------------	------------	----------------------------------------------------------------------------------------------

Note: The display in step 8 has a negative sign because it represents a cash outflow (investment) today.









D. Calculating the future value of a lump sum amount:




**Example:** If John invests \$1,850 today in an asset earning a 10% rate of return (compounded annually), how much will he have after two years?

Keystrokes	Display	Description
Clear the memory and financial registers.		
1.      	-1,850.00	Records the present cash outflow of \$1,850.00.
2.   	10.00	Records the annual interest rate of 10%.
3.  	2.00	Records the number of time periods as 2.
4. 	2,238.50	Calculates the future value of \$1,850 after two years at 10%.

E. Calculating the present value of an annuity:

**Example:** How much should you invest now so that starting one year from today your daughter can receive \$6,000 per year for the next five years? Assume the discount rate is 15%.

Keystrokes	Display	Description
Clear the memory and financial registers.		
1.     	6,000.00	Records the amount of the periodic payments.
2.   	15.00	Records the annual interest rate of 15%.






3.	 	5.00	Records the number of time periods as 5.
4.		-20,112.93.00	Calculates the present value of the annuity.

F. Calculating the present value of an annuity due:







**Example:** In this case, instead of receiving payments at the end of each year, your daughter will receive the payments at the beginning of each year. Therefore, her first payment will be received immediately.







There are two methods to calculate the present value of an annuity due:

1. *You can calculate the present value of an annuity, as shown in Section E, and multiply it by (1 + k). In that case the additional step would be:*

Keystrokes	Display	Description
Follow steps 1–4 from Section E.		
5.    	1.15	Records the second term (1 + k) in the formula for an annuity due.
6. 	-23,129.87	Calculates the PV of the annuity due.















2. *The HP 12C allows you to set the timing of the payment. You have to set the payment mode at “BEGIN” and start from the first step. This method is shown below:*

Keystrokes	Display	Description
Clear the memory and financial registers.		
1.  <b>BEG</b>	BEGIN	Displays BEGIN at the bottom of the screen to indicate that payment is made at the beginning of the period.
2.     	6,000.00	Records the amount of the periodic payments.

3.	  	15.00	Records the annual interest rate of 15%.
4.	 	5.00	Records the number of time periods as 5.
5.	 END		Toggles to the default setting of end-of-the-period payments.

G. Calculating the future value of an annuity:

**Example:** You have recently won a lottery for \$10,000. Your winnings will come in five annual payments of \$2,000 each starting one year from now. If the annual compound rate is 11.4%, how much is the lottery worth at the end of five years?

Keystrokes	Display	Description
Clear the memory and financial registers.		
1.     	2,000.00	Records the amount of periodic payments.
2.     	11.4	Records the annual rate of interest of 11.4%.
3.  	5.00	Records the number of time periods as 5.
4.  	12,555.07	Calculates the FV of an annuity.

H. Calculating the future value of an annuity due:

**Example:** In this case, your winnings will be paid at the beginning instead of at the end of each year for five years. So you are going to get the first payment of your \$10,000 lottery, i.e. \$2,000, immediately. There are two methods to calculate the future value of an annuity due:

1. *You can calculate the future value of an annuity, as shown in Section G, and multiply it by (1 + k). In that case the additional step would be:*

Keystrokes	Display	Description
Follow steps 1–4 from Section G.		
5. 1 . 1 1 4	1.114	Records the second (1 + k) term in the formula for an annuity due.
6. ×	13,986.35	Calculates the FV of the annuity due.

2. *The HP 12C allows you to set the timing of the payment. You have to set the payment mode at “BEGIN” and start from the first step. This method is shown below.*

Keystrokes	Display	Description
Clear the memory and financial registers.		
1. 9 <span>BEG</span>	BEGIN	Displays the BEGIN at the bottom of the screen to indicate that payment is made at the beginning of the period.
2. 2 0 0 0 PMT	2,000.00	Records the amount of periodic payments.
3. 1 1 . 4 i	11.40	Records the annual rate of interest of 11.4%.
4. 5 n	5.00	Records the number of time periods as 5.
5. FV CHS	13,986.35	Calculates the FV of an annuity due.
6. 9 <span>END</span>		Toggles to the default setting of end-of-the-period payments.

I. **Calculating the net present value of an annuity:**

**Example:** Jane thinks if she invests \$80,000 by buying property today, she can get \$15,000 in rent from it for each of the next 20 years (the rent will be paid quarterly). If she wants a rate of return of 12% (with quarterly discounting) on her investment, what is the net present value of this project?

1. The annual rate of return will be divided by four, i.e., the quarterly rate of return will be 3%.

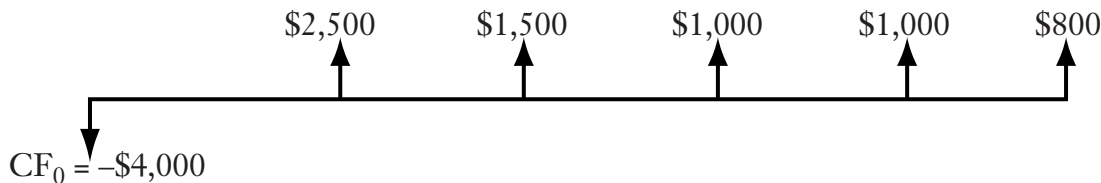
- 2. The number of time periods will be multiplied by four, i.e., 80.
- 3. The amount of annual rent will be divided by four, i.e., \$3,750.

Keystrokes	Display	Description
Clear the memory and financial registers.		
1. 8 0 0 0 0 CHS	-80,000	Records the initial cash out-flow of \$80,000.
2. 9 CFO	-80,000.00	Stores the initial investment in the financial register.
3. 3 7 5 0 9 CFj	3,750.00	Stores cash inflow amount.
4. 8 0 9 Nj	80.00	Records the number of time periods as 80.
5. 3 i	3.00	Records the quarterly interest rate of 3%.
6. f NPV	33,252.86	Calculates the net present value of the investment.

J. Calculating the net present value of a series of uneven cash flows:

The HP12C can store 24 cash flow groups besides the initial cash investment. A cash flow group comprises the cash flow amount and the number of times it repeats consecutively in the cash flow series. Each cash flow group can have up to 9,999 cash flows; that is the maximum value of Fnn (the frequency of consecutive cash flows in one group) can be 9,999.

**Example:** Beth is planning to buy a Pentium-based PC for rental purposes. She has calculated that her expected cash flows from the investment for the next five years would be as shown below.



If she has to pay an annual interest rate of 9.75%, should she buy the computer?

Keystrokes	Display	Description
Clear the memory and financial registers.		
1. 4 0 0 0 CHS	-4,000.00	Enters the initial investment of \$4,000.
2. 9 CFO	-4,000.00	Stores the initial investment in the financial register.
3. 2 5 0 0 9 CFj	2,500.00	Stores the first cash inflow amount.
4. 1 5 0 0 9 CFj	1,500.00	Stores the second cash inflow amount.
5. 1 0 0 0 9 CFj	1,000.00	Stores the third cash inflow amount.
6. 2 9 Nj	2.00	Records that \$1,000 occurs twice for both the third and fourth time periods.
7. 8 0 0 9 CFj	800.00	Stores the fifth cash inflow amount.
8. 9 . 7 5 I	9.75	Records the annual interest rate of 9.75%.
9. f NPV	1,471.57	Calculates the net present value of the investment.

K. Calculating the internal rate of return of an annuity:

**Example:** ABC Inc. is planning to spend \$35,000 to buy a warehouse. Under the contract they will receive an after-tax cash flow of \$6,000 (paid semiannually) from the property for the next eight years. What is the internal rate of return for the investment?

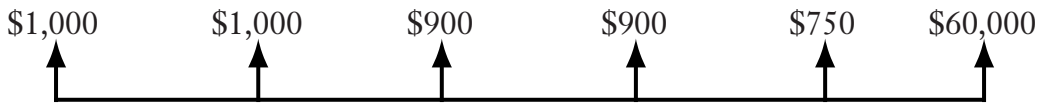
Keystrokes	Display	Description
Clear the memory and financial registers.		
1. 3 5 0 0 0 CHS	-35,000	Enters the initial investment of \$35,000.



2.	<b>g</b> CFO	-35,000.00	Stores the initial investment in the financial register.
3.	<b>3</b> <b>0</b> <b>0</b> <b>0</b> <b>g</b> CFj	3,000.00	Stores the semi-annual cash inflow amount.
4.	<b>1</b> <b>6</b> <b>g</b> Nj	16.00	Stores the total number of time periods as 16.
5.	<b>f</b> IRR	3.98	Calculates the semi-annual IRR.
6.	<b>2</b> <b>×</b>	7.97	Calculates the IRR of the investment.

L. Calculating the internal rate of return of a series of uneven cash flows:

**Example:** Healthtime has the opportunity to make an investment that requires an initial cash outflow of \$6,500. The estimated cash inflows from the project for the next six years are shown below. What is the IRR on this investment?



$CF_0 = -\$6,500$















Keystrokes	Display	Description
Clear the memory and financial registers.		
1. <b>6</b> <b>5</b> <b>0</b> <b>0</b> <b>CHS</b>	-6,500	Enter the initial investment of \$6,500.
2. <b>g</b> CFO	-6,500.00	Stores the initial investment in the financial register.
3. <b>1</b> <b>0</b> <b>0</b> <b>0</b> <b>g</b> CFj	1,000.00	Stores the first cash inflow amount
4. <b>2</b> <b>g</b> Nj	2.00	Stores \$1,000 as the cash inflow amount for both the first and second periods.

5.	<div>900g</div>	CFj	900.00	Stores the amount of the third cash inflow.
6.	<div>29</div>	Nj	2.00	Records that \$900 occurs twice for the third and fourth periods.
7.	<div>750g</div>	CFj	750.00	Stores the fifth cash inflow amount.
8.	<div>60000g</div>	CFj	60,000.00	Stores the sixth cash inflow amount.
9.	<div>f</div>	IRR	51.88	Calculates the internal rate of return for the cash flow series.

M. Bond valuation with interest compounded annually:

**Example:** How much would you be willing to pay for a bond today if it pays \$100 in interest annually for 20 years (starting next year) and has a principal payment of \$1,000? The yield to maturity is 15%.

This question can be interpreted as that of finding the NPV of an uneven cash flow series with the initial cash outflow equal to zero. Hence, we will follow the steps used for calculating NPV to compute the current price of the bond.

Keystrokes	Display	Description
Clear the memory and financial registers.		
1.   CFO	0.00	Stores the initial investment as zero in the financial register.
2.     CFj	100.00	Stores the first cash inflow amount.
3.    Nj	19.00	Records that interest payments of \$100 occur 19 times.
4.      CFj	1100.00	Stores the amount of the last cash inflow (interest + principal).
























5.	  	15.00	Records the yield-to-maturity as 15%.
6.	 	687.03	Computes the current bond price.

N. Bond valuation with interest compounded semiannually:

Because most bonds pay interest semiannually, we will show the conversion required to calculate the current value of such bonds.

**Example:** If the bond described in Section M pays interest semiannually, the calculations will be:


$I_t = \$50, P_n = \$1000, i = 7.5\%, n = 40.$

Keystrokes	Display	Description
Clear the memory and financial registers.		
1.   	0.00	Stores the initial investment as zero in the financial register.
2.    	500.00	Stores the first cash inflow amount.
3.    	39.00	Records that interest payments of \$50 occur 39 times.
4.      	1050.00	Stores the amount of the last cash inflow (interest + principal payment).
5.    	7.50	Records the semi-annual YTM as 7.5%.
6.  	685.14	Calculates the current bond value.



# Hewlett Packard (HP) 17BII




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The HP 17BII contains a two-line display space for messages, prompts, and labels. Menus and messages show you options and guide you through problems. Some keys and functions are activated by pressing the “SHIFT” key, which is the amber colored key (  ) located at the far left on the second line of keys from the bottom. The “CLR” (clear key) clears the calculator display line. Pressing “SHIFT” “CLEAR DATA” will clear all information in the current work area such as a time value of money worksheet.

It is also important to note that most financial calculations are accomplished by accessing the appropriate variable as displayed on the display panel. In order to select a particular variable, it is necessary to press the up arrow symbol “^” located directly beneath the variable along the row of keys just beneath the display panel. For the sake of brevity in this guide, only the actual variable name will be indicated even though the up arrow symbol beneath the variable is actually pressed. To return to the main display line menu, simply press “SHIFT” “MAIN”. To back out of a particular menu without going all the way back to the main menu, simply press EXIT.

The HP 17BII has continuous memory. Therefore, turning of the calculator does not affect the information you have previously stored in the calculator. If not turned off manually, the calculator will turn off automatically approximately 10 minutes after last use.






























## A. Clearing the calculator display and memory and setting the decimal points:

Keystrokes	Display	Description
1.  CLEAR DATA	0.00	Clears screen and storage registers.
2.  FIX 	0.00	Sets the number of decimal places equal to 2.

## B. Using the memory capability:

**Example:** Before leaving on a sales call one morning, Alfred stored the price of a fax machine (\$1,200) and a printer (\$1,000) in his calculator. Later that day, he sold three fax machines

and four printers to a customer. He used his calculator to get the total amount due from this customer in the following way:

Keystrokes	Display	Description
Clear all memory and financial registers.		
1.      	1,200.00	Stores the price of the fax machine in memory location 1.
2.      	1,000.00	Stores the price of the printer in memory location 2.
3.  OFF		Turns the calculator off.
Later that day:		
4. ON	1,000.00	After the sale, Alfred turns the calculator on.
5.  	1,200.00	Recalls the cost of the fax to the display.
6.   	3,600.00	Multiplies 1,200 by 3 to calculate the cost of the three fax machines.
7.  	3,600.00	Stores the cost of the three fax machine.
8.  	1,000.00	Recalls the cost of the printer.
9.   	4,000.00	Calculates cost of four printers.
10.    	7,600.00	Totals the amount for this sale.

C. Navigating Menus

The main menu is obtained by turning the calculator ON. The main Menu appears as follows:

---

0.00
FIN    BUS    SUM    TIME    SOLVE

---


For most calculations finance students will undertake, it will be necessary to next select the finance menu by selecting FIN, and then TVM for time value of money. The TVM menu appears as follows:

---

12 P/YR	END	MODE
N    I%Y    PV    PMT    FV    OTHER		

---

The HP 17BII is programmed with the assumption that interest is compounded 12 times each year (monthly compounding). This manual will reset the number of compounding periods to once per year and adjust the interest rate as needed in the calculations. The number of compounding periods and interest can be set to annual compounding as follows:


Keystrokes	Display	Description
1. Select the TVM Menu		
2. OTHER  P/YR	1 P/YR    END MODE	Sets the calculator for annual compounding (one compounding period per year).

---

Note: To back out of menus, simply press the EXIT key.

**D. Calculating the present value of a lump sum amount:**

**Example:** Liz anticipates it will cost her \$65,000 to buy a house in 18 months. How much should she invest today at an annual interest rate of 15% (interest is compounded monthly) to be able to afford the house in one and a half years?

Keystrokes	Display	Description
1.  CLEAR DATA	0.00	Clears previously stored data.
2. FIN TVM	1 P/YR END MODE	Accesses the TVM Menu

3.	<div>65000</div>	FV	FV=65,000.00	Records the FV amount of \$65,000.
4.	<div>15 ÷ 12</div>	= I%YR	I%YR=1.25	Records the monthly interest rate of 1.25%
5.	<div>18</div>	N	N=18	Records the number of monthly periods as 18.
6.	PV		PV = -51,975.99	Calculates the present value.

Note: The display in step 8 has a negative sign because it represents a cash outflow (investment) today.

E . Calculating the future value of a lump sum amount:

**Example:** If John invests \$1,850 today in an asset earning a 10% rate of return (compounded annually), how much will he have after two years?

Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1. <div>1850 +/-</div> PV	PV = -1,850.00	Records the present cash outflow of \$1,850.00.
2. <div>10</div> I%YR	I%YR = 10.00	Records the annual interest rate of 10%.
3. <div>2</div> N	N = 2.00	Records the number of time periods as 2.
4. FV	FV = 2,238.50	Calculates the future value of \$1,850 after two years at 10%.

F. Calculating the present value of an annuity:

**Example:** How much should you invest now so that starting one year from today your daughter can receive \$6,000 per year for the next five years? Assume the discount rate is 15%.



Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1. 6 0 0 0 PMT	PMT = 6,000.00	Records the amount of the periodic payments.
2. 1 5 I%YR	I%YR = 15.00	Records the annual interest rate of 15%.
3. 5 N	N = 5.00	Records the number of time periods as 5.
4. PV	PV = -20,112.93	Calculates the present value of the annuity.

G. Calculating the present value of an annuity due:









**Example:** In this case, instead of receiving payments at the end of each year, your daughter will receive the payments at the beginning of each year. Therefore, her first payment will be received immediately.

There are two methods to calculate the present value of an annuity due:

1. *You can calculate the present value of an annuity, as shown in section F, and multiply it by (1 + k). In that case the additional step would be:*











Keystrokes	Display	Description
Follow steps 1–4 from Section F.		
5. × 1 . 1 5 =	-23,129.87	Records the second term (1 + k) in the formula for an annuity due.

2. *The HP 17BII allows you to set the timing of the payment. You have to set the payment mode at “BEGIN” and start from the first step. This method is shown below:*

Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1. 0 OTHER BEG	1 P/YR BEGIN MODE	Sets the calculator to beginning of the period payments.
2.      PMT	PMT = 6,000.00	Records the amount of the periodic payments.
3.   I%YR	I%YR = 15.00	Records the annual interest rate of 15%.
4.  N	N = 5.00	Records the number of time periods as 5.
5. PV	PV = - 23,129.87	Calculates the PV of the annuity due.

H. Calculating the future value of an annuity:








**Example:** You have recently won a lottery for \$10,000. Your winnings will come in five annual payments of \$2,000 each starting one year from now. If the annual compound rate is 11.4%, how much is the lottery worth at the end of five years?

Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1.     PMT	PMT = 2,000.00	Records the amount of periodic payments.
2.     I%YR	I%YR = 11.4	Records the annual rate of interest of 11.4%.
3.  N	N = 5.00	Records the number of time periods as 5.
4. FV 	FV = 12,555.07	Calculates the FV of an annuity.













I. Calculating the future value of an annuity due:

**Example:** In this case, your winnings will be paid at the beginning instead of at the end of each year for five years. So you are going to get the first payment of your \$10,000 lottery, i.e. \$2,000, immediately. There are two methods to calculate the future value of an annuity due:

- 1. *You can calculate the future value of an annuity, as shown in section H, and multiply it by (1 + k). In that case the additional step would be:*

Keystrokes	Display	Description
Follow steps 1–4 from Section H.		
5.       	13,986.35	Calculates the FV of the annuity due.
















- 2. *The HP 17BII allows you to set the timing of the payment. You have to set the payment mode at “BEGIN” and start from the first step. This method is shown below.*

Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1.  	1 P/YR BEGIN MODE	Sets the calculator to beginning of the period payments.
2.      PMT	PMT = 2,000.00	Records the amount of the periodic payments.
3.     I%YR	I%YR = 11.40	Records the annual interest rate of 11.4%.
4.  N	N = 5.00	Records the number of time periods as 5.
5. FV	FV = -13,986.35	Calculates the FV of the annuity due.

J. Calculating the net present value of an annuity:

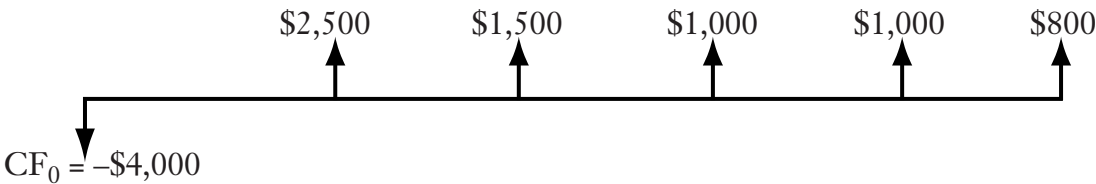
**Example:** Jane thinks if she invests \$80,000 by buying property today, she can get \$15,000 in rent from it for each of the next 20 years (the rent will be paid quarterly). If she wants a rate of return of 12% (with quarterly discounting) on her investment, what is the net present value of this project?

- 1. The annual rate of return will be divided by four, i.e., the quarterly rate of return will be 3%.
- 2. The number of time periods will be multiplied by four, i.e., 80.
- 3. The amount of annual rent will be divided by four, i.e., \$3,750.

Keystrokes	Display	Description
1. ON  CLEAR DATA	0.00	Turns on and clears the calculator
2. FIN CFLO	FLOW (0) = ?	Selects the cash flow data input register.
3.       INPUT	FLOW (1) = ? -80,000.00	Stores the initial investment in the financial register.
4.     INPUT	TIMES (1) = 1	Enters the quarterly annuity cash inflow and prompts the user to enter the number of periods.
5.   INPUT  CALC	NPV, NUS, NFV = 1%	Enters the number of periods and prompts the user for the interest rate.
6.  I%NPV	NPV = 33,252.86	Enters the quarterly interest rate and calculates the net present value of the investment.

K. Calculating the net present value of a series of uneven cash flows:

**Example:** Beth is planning to buy a Pentium-based PC for rental purposes. She has calculated that her expected cash flows from the investment for the next five years would be as shown below.



If she has to pay an annual interest rate of 9.75%, should she buy the computer?

Keystrokes	Display	Description
1. ON  CLEAR DATA	0.00	Turn on and clear the calculator
2. FIN	FLOW (0) = ?	Select the cash flow data input register.
3. 	FLOW (1) = ? -4,000.00	Stores the initial investment in the financial register.
4. 	FLOW (2) = ? 1.00	Stores the second cash inflow amount.
5. 	FLOW (3) = ? 1.00	Stores the third cash inflow amount.
5. 	FLOW (4) = ? 2.00	Stores the third and fourth cash inflow.
6.	2.00	Stores the fifth cash inflow amount.

7.

EXIT

CALC
- 9

.

7

5

I%

I% = 9.75

Enters the discount rate.
8.

NPV

1,471.57

Calculates the net present value of the investment.

L. Calculating the internal rate of return of an annuity:

**Example:** ABC Inc. is planning to spend \$35,000 to buy a warehouse. Under the contract they will receive an after-tax cash flow of \$6,000 (paid semiannually) from the property for the next eight years. What is the internal rate of return for the investment?


































Keystrokes	Display	Description
1. <div>ON</div> <div></div> <div>CLEAR DATA</div>	0.00	Turns on and clears the calculator
2. <div>FIN</div> <div>CFL0</div>	FLOW (0) = ?	Selects the cash flow data input register.
3. <div>3</div> <div>5</div> <div>0</div> <div>0</div> <div>0</div> <div>+/-</div> <div>INPUT</div> <div>FLOW (1) = ? -35,000.00</div>		Stores the initial investment in the financial register.
4. <div>3</div> <div>0</div> <div>0</div> <div>0</div> <div>INPUT</div> <div>TIMES (1) = 1</div>		Enters the semiannual annuity cash inflow and prompts the user to enter the number of periods.
5. <div>1</div> <div>6</div> <div>INPUT</div> <div>EXIT</div> <div>CALC</div> <div>NPV, NUS, NFV = I%</div>		Enters the number of semi-annual time periods.
6. <div>IRR</div>	IRR% = 3.98	Results in the present value of the investment.
7. <div>×</div> <div>2</div> <div>=</div>	7.97	Compute the IRR


M. Calculating the internal rate of return of a series of uneven cash flows:

**Example:** Healthtime has the opportunity to make an investment that requires an initial cash outflow of \$6,500. The estimated cash inflows from the project for the next six years are shown below. What is the IRR on this investment?



$CF_0 = -\$6,500$

Keystrokes	Display	Description
1. ON  CLEAR DATA	0.00	Turn on and clear the calculator
2. FIN  CFL0	FLOW (0) = ?	Select the cash flow data input register.
3.      	FLOW (1) = ? -6,500.00	Stores the initial investment in the financial register.
4.       	FLOW (2) = ? 2.00	Stores the first and second cash inflow amounts.
5.      	FLOW (3) = ? 2.00	Stores the third and fourth cash inflow amounts.
6.     	FLOW (4) = ? 1.00	Stores the fifth cash inflow amount.
7.       	FLOW (5) = ? 1.00	Stores the sixth cash inflow amount.

8.  CALC IRR

IRR% = 51.88












Calculates the IRR.

N. Bond valuation with interest compounded annually:

The HP 17BII has an extremely sophisticated bond calculator menu that is often used by practicing bond professionals. However, most finance students using the HP 17BII will be given bond data in a simplified format. As a result, it is more simple and convenient to use the time value of money (TVM) menu. This guide will therefore illustrate bond valuation principles using the TVM menu.

**Example:** How much would you be willing to pay for a bond today if it pays \$100 in interest annually for 20 years (starting next year) and has a principal payment of \$1,000? The yield to maturity is 15%.

This question can be interpreted as that of finding the NPV of an uneven cash flow series, with the initial cash outflow equal to zero. Hence, we will follow the steps used for calculating NPV to compute the current price of the bond.

Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1.    PMT	PMT = 100.00	Records the amount of the annual coupon payments.
2.   I%YR	I%YR = 15.00	Records the yield-to-maturity of 15%.
3.   N	N = 20.00	Records the number of time periods as 20.
4.     FV	FV = 1,000.00	Records the future or face value of the bond.
5. PV	PV = -687.03	Calculates the present value of the Bond

O. Bond valuation with interest compounded semiannually:

Because most bonds pay interest semiannually, we will show the conversion required to calculate the current value of such bonds.






**Example:** If the bond described in Section N pays interest semiannually, the calculations will be:  
 $I_t = \$50, P_n = \$1000, I = 7.5\%, n = 40.$



Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1. 5 0 PMT	PMT = 50.00	Records the amount of the semiannual coupon payments.
2. 7 . 5 I%YR	I%YR = 7.50	Records the semiannual yield-to-maturity of 7.5%.
3. 4 0 N	N = 40.00	Records the number of time periods as 40.
4. 1 0 0 0 FV	FV = 1,000.00	Records the future or face value of the bond.
5. PV	PV = -685.14	Calculates the present value of the bond



# Hewlett Packard (HP) 19BII




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The HP 19BII is extremely sophisticated and contains a multi-line display space for messages, prompts, and labels. This manual will discuss only a small fraction of the 19BII's capabilities, focusing primarily on its time value of money functions. Menus and messages show you options and guide you through problems. Some keys and functions are activated by pressing the "SHIFT" key, which is the amber colored key (  ) located at the far left on the second line of keys from the top. The  CLR key combination clears the calculator display line. Pressing  CLEAR DATA will clear all information in the current work area such as a time value of money worksheet.

It is also important to note that most financial calculations are accomplished by accessing the appropriate variable as displayed on the display panel. In order to select a particular variable, it is necessary to press the GRAY key located directly beneath the variable along the row of keys just beneath the display panel. For the sake of brevity in this guide, only the actual variable name will be indicated even though the up arrow symbol beneath the variable is actually pressed. To return to the main display line menu, simply press  MAIN. To back out of a particular menu without going all the way back to the main menu, simply press  .

The HP 19BII has continuous memory. Therefore, turning of the calculator does not affect the information you have previously stored in the calculator. If not turned off manually, the calculator will turn off automatically approximately 10 minutes after last use.

## A. Clearing the calculator display and memory, and setting the decimal points:

Keystrokes	Display	Description
1.  CLEAR DATA	0.00	Clears screen and storage registers.
2.  FIX  INPUT	0.00	Sets the number of decimal places equal to 2.

B. Using the memory capability:

**Example:** Before leaving on a sales call one morning, Alfred stored the price of a fax machine (\$1,200) and a printer (\$1,000) in his calculator. Later that day, he sold three fax machines and four printers to a customer. He used his calculator to get the total amount due from this customer in the following way:

Keystrokes	Display	Description
Clear all memory and financial registers.		
1. 1 2 0 0 STO 1	1,200.00	Stores the price of the fax machine in memory location 1.
2. 1 0 0 0 STO 2	1,200.00	
	1,000.00	Stores the price of the printer in memory location 2.
3. ON		Turns the calculator off.
Later that day:		
4. ON	1,200.00	After the sale, Alfred turns the calculator on.
	1,000.00	
	1,200.00	
5. RCL 1	1,200.00	Recalls the cost of the fax to the display.
	1,000.00	
	1,200.00	
6. × 3 =	1,200.00	Multiplies 1,200 by 3 to calculate the cost of the three fax machines.
	1,000.00	
	3,600.00	
7. STO 3	1,200.00	Stores the cost of the three fax machines.
	1,000.00	
	3,600.00	

8.	RCL	2	1,000.00	
			3,600.00	
			1,000.00	Recalls the cost of the printer.
9.	×	4	1,000.00	
		=	3,600.00	
			4,000.00	Calculates cost of four printers.
10.	+	RCL	1,000.00	
		3	3,600.00	
		=	7,600.00	Totals the amount for this sale.

C. Navigating Menus

The main menu is obtained by turning the calculator ON. The main menu appears as follows:

0.00

FINBUSSUMTIMESOLVETEXT

For most calculations finance students will undertake, it will be necessary to next select the finance menu by selecting FIN, and then TVM for time value of money. The TVM menu appears as follows:

12 P/YRENDMODE

0.00

N I%Y PV PMT FV OTHER

The HP 19BII is programmed with the assumption that interest is compounded 12 times each year (monthly compounding). This manual will reset the number of compounding periods to once per year and adjust the interest rate as needed in the calculations. The number of compounding periods and interest can be set to annual compounding as follows:

Keystrokes	Display	Description
1. Select the TVM Menu		
2.   P/YR	1 P/YR END MODE	Sets the calculator for annual compounding (one compounding period per year).

Note: To back out of menus, simply press the EXIT key.

D. Calculating the present value of a lump sum amount:

**Example:** Liz anticipates it will cost her \$65,000 to buy a house in 18 months. How much should she invest today at an annual interest rate of 15% (interest is compounded monthly) to be able to afford the house in one and a half years?

Keystrokes	Display	Description
1.	0.00	Clears previously stored data.
2.	1 PMTS/YR: END MODE 0.00	Accesses the TVM Menu
3.	FV FV=65,000.00	Records the FV amount of \$65,000.
4. I%YR	I%YR=1.25	Records the monthly interest rate of 1.25%
5.	N=18	Records the number of monthly periods as 18.
6.	PV = -51,975.99	Calculates the present value.

Note: The display in step 8 has a negative sign because it represents a cash outflow (investment) today.

E . Calculating the future value of a lump sum amount:

**Example:** If John invests \$1,850 today in an asset earning a 10% rate of return (compound-  
ed annually), how much will he have after two years?

Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1. <b>1</b> <b>8</b> <b>5</b> <b>0</b> <b>+/-</b> <b>PV</b>	PV = -1,850.00	Records the present cash out-flow of \$1,850.00.
2. <b>1</b> <b>0</b> <b>I%YR</b>	I%YR = 10.00	Records the annual interest rate of 10%.
3. <b>2</b> <b>N</b>	N = 2.00	Records the number of time periods as 2.
4. <b>FV</b>	FV = 2,238.50	Calculates the future value of \$1,850 after two years at 10%.

#### F. Calculating the present value of an annuity:

**Example:** How much should you invest now so that starting one year from today your daughter can receive \$6,000 per year for the next five years? Assume the discount rate is 15%.







Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1. <b>6</b> <b>0</b> <b>0</b> <b>0</b> <b>PMT</b>	PMT = 6,000.00	Records the amount of the periodic payments.
2. <b>1</b> <b>5</b> <b>I%YR</b>	I%YR = 15.00	Records the annual interest rate of 15%.
3. <b>5</b> <b>N</b>	N = 5.00	Records the number of time periods as 5.
4. <b>PV</b>	PV = -20,112.93	Calculates the present value of the annuity.

#### G. Calculating the present value of an annuity due:










**Example:** In this case, instead of receiving payments at the end of each year, your daughter will receive the payments at the beginning of each year. Therefore, her first payment will be received immediately.

There are two methods to calculate the present value of an annuity due:

- 1. *You can calculate the present value of an annuity, as shown in Section F, and multiply it by (1 + k). In that case the additional step would be:*

Keystrokes	Display	Description
Follow steps 1–4 from Section F.		
5.      	-23,129.87	Records the second term (1 + k) in the formula for an annuity due.











- 2. *The HP 19BII allows you to set the timing of the payment. You have to set the payment mode at “BEGIN” and start from the first step. This method is shown below:*

Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1.  OTHER BEG	1 P/YR: BEGIN MODE 0.00	Sets the calculator to beginning of the period payments.
2.      PMT	PMT = 6,000.00	Records the amount of the periodic payments.
3.   I%YR	I%YR = 15.00	Records the annual interest rate of 15%.
4.  N	N = 5.00	Records the number of time periods as 5.
5. PV	PV = - 23,129.87	Calculates the PV of the annuity due.

**H. Calculating the future value of an annuity:**

**Example:** You have recently won a lottery for \$10,000. Your winnings will come in five annual payments of \$2,000 each starting one year from now. If the annual compound rate is 11.4%, how much is the lottery worth at the end of five years?










Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1.     PMT	PMT = 2,000.00	Records the amount of periodic payments.
2.     I%Y	I%YR = 11.4	Records the annual rate of interest of 11.4%.
3.  N	N = 5.00	Records the number of time periods as 5.
4. FV 	12,555.07	Calculates the FV of an annuity.











**I. Calculating the future value of an annuity due:**

**Example:** In this case, your winnings will be paid at the beginning instead of at the end of each year for five years. So you are going to get the first payment of your \$10,000 lottery, i.e. \$2,000, immediately. There are two methods to calculate the future value of an annuity due:

1. *You can calculate the future value of an annuity, as shown in section H, and multiply it by (1 + k). In that case the additional step would be:*

Keystrokes	Display	Description
Follow steps 1–4 from Section H.		
5.       	13,986.35	Calculates the FV of the annuity due.



2. *The HP 19BII allows you to set the timing of the payment. You have to set the payment mode at “BEGIN” and start from the first step. This method is shown below.*

Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1. 0 OTHER BEG	1 P/YR: BEGIN MODE 0.00	Sets the calculator to beginning of the period payments.
2.      PMT	PMT = 2,000.00	Records the amount of the periodic payments.
3.     I%YR	I%YR = 11.40	Records the annual interest rate of 11.4%.
4.  N	N = 5.00	Records the number of time periods as 5.
5. FV	FV = -13,986.35	Calculates the FV of the annuity due.

J. Calculating the net present value of an annuity:

**Example:** Jane thinks if she invests \$80,000 by buying property today, she can get \$15,000 in rent from it for each of the next 20 years (the rent will be paid quarterly). If she wants a rate of return of 12% (with quarterly discounting) on her investment, what is the net present value of this project?

- 1. The annual rate of return will be divided by four, i.e., the quarterly rate of return will be 3%.
- 2. The number of time periods will be multiplied by four, i.e., 80.
- 3. The amount of annual rent will be divided by four, i.e., \$3,750.

Keystrokes	Display	Description
1.   CLEAR DATA	0.00	Turns on and clears the calculator
2. FIN CFL0	INITIAL FLOW ?INIT = 0.00	Selects the cash flow data

input register.

3. **8** **0** **0** **0** **0**  
**+/-** **INPUT**

?FLOW (1) =

#TIMES =

-80,000.00

Stores the initial investment in the financial register.

4. **3** **7** **5** **0** **INPUT**

FLOW (1) = 3,750.00

?#TIMES (1) = 1

1.00

Enters the quarterly annuity cash inflow and prompts the user to enter the number of periods.

5. **8** **0** **INPUT** **CALC**

I% NEEDED TO CALCULATE

NPV, NUS, AND NFV

80.00

Enters the number of periods and prompts the user for the interest rate.

6. **3** **I%** **NPV**

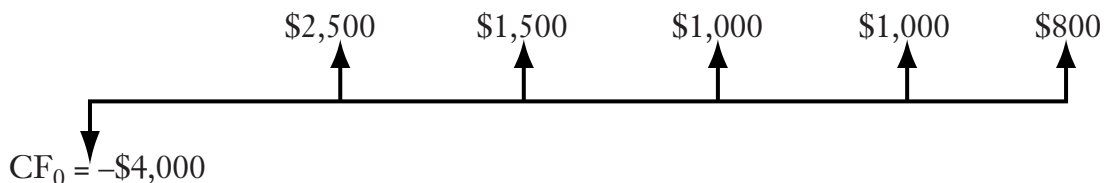
I% = 3.00

NPV = 33,252.86




























Enters the quarterly interest rate and calculates the net present value of the investment.

### K. Calculating the net present value of a series of uneven cash flows:

**Example:** Beth is planning to buy a Pentium-based PC for rental purposes. She has calculated that her expected cash flows from the investment for the next five years would be as shown below.



If she has to pay an annual interest rate of 9.75%, should she buy the computer?

Keystrokes	Display	Description
1.  	0.00	Turns on and clears the calculator
2. FIN CFLD	INITIAL FLOW ?INIT = 0.00	Selects the cash flow data input register.
3.      	?FLOW (1) = #TIMES = -4,000.00	Stores the initial investment in the financial register.
4.      	?FLOW (2) = #TIMES 1.00	Enters the first annual cash inflow and selects one period for the number of occurrences of this cash flow.
5.      	?FLOW (3) = #TIMES (1) = 1.00	Enters the second annual cash inflow and selects one period for the number of occurrences of this cash flow.
6.       	?FLOW (4) = #TIMES (1) = 2.00	Enters the third annual cash inflow and selects one period for the number of occurrences

7.

8

0

0

INPUT

INPUT

?FLOW (5) =

#TIMES (1) =

1.00

of this cash flow.

Enters the last annual cash inflow and selects one period for the number of occurrences of this cash flow.
8.

CALC

9

.

7

5

I% NPV

I% = 9.75

NPV = 1,471.37

Enters the annual interest rate and calculates the net present value of the investment.

L. Calculating the internal rate of return of an annuity:

**Example:** ABC Inc. is planning to spend \$35,000 to buy a warehouse. Under the contract they will receive an after-tax cash flow of \$6,000 (paid semiannually) from the property for the next eight years. What is the internal rate of return for the investment?

Keystrokes	Display	Description
1. <div><div>ON</div><div></div><div>CLEAR DATA</div></div>	0.00	Turns on and clears the calculator
2. FIN CFLO	INITIAL FLOW ?INIT = 0.00	Selects the cash flow data input register.
3. <div><div>3</div><div>5</div><div>0</div><div>0</div><div>0</div><div>+/-</div><div>INPUT</div></div>	?FLOW (1) = #TIMES = -35,000.00	Stores the initial investment in the financial register.

4.

3

0

0

0

INPUT

FLOW (1) = 3,000.00

?#TIMES (1) = 1

1.00

Enters the semiannual annuity cash inflow and prompts the user to enter the number of periods.
5.

1

6

INPUT

CALC

1% NEEDED TO CALCULATE NPV, NUS, AND NFV

16.00

Enters the number of semiannual time periods.
6.

IRR

×

2

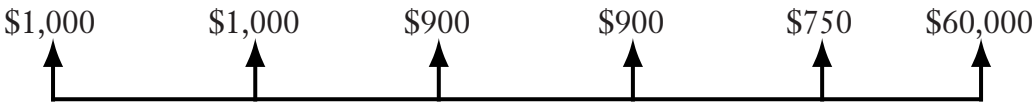
=

7.97

Calculates the semiannual IRR, which must then be converted to an annual IRR.

M. Calculating the internal rate of return of a series of uneven cash flows:

**Example:** Healthtime has the opportunity to make an investment that requires an initial cash outflow of \$6,500. The estimated cash inflows from the project for the next six years are shown below. What is the IRR on this investment?



$CF_0 = -\$6,500$

Keystrokes	Display	Description
1. <div>ON</div> <div></div> CLEAR DATA	0.00	Turns on and clears the calculator.
2. FIN CFL0	INITIAL FLOW ?INIT = 0.00	Select the cash flow data input register.

3. 

?FLOW (1) =

#TIMES =

-6,500.00

Stores the initial investment in the financial register.

4. 

?FLOW (2) =

#TIMES

2.00

Enters the first annual cash inflow and selects two periods for the number of occurrences of this cash flow.

5. 

?FLOW (3) =

#TIMES (1) =

2.00

Enters the second annual cash inflow and selects two periods for the number of occurrences of this cash flow.

6. 

?FLOW (4) =

#TIMES (1) =

1.00

Enters the third annual cash inflow and selects one period for the number of occurrences of this cash flow.

7. 

?FLOW (5) =

#TIMES (1) =

1.00

Enters the last annual cash inflow and selects one period for the number of occurrences of this cash flow.

8. CALC IRR	IRR% = 51.88	Enters the annual interest rate and calculates the net present value of the investment.
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N. Bond valuation with interest compounded annually:

The HP 19BII has an extremely sophisticated bond calculator menu that is often used by practicing bond professionals. However, most finance students using the HP 19BII will be given bond data in a simplified format. As a result, it is more simple and convenient to use the time value of money (TVM) menu. This guide will therefore illustrate bond valuation principles using the TVM menu.

**Example:** How much would you be willing to pay for a bond today if it pays \$100 in interest annually for 20 years (starting next year) and has a principal payment of \$1,000? The yield to maturity is 15%.

This question can be interpreted as that of finding the NPV of an uneven cash flow series with the initial cash outflow equal to zero. Hence, we will follow the steps used for calculating NPV to compute the current price of the bond.

Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1. 1 0 0 PMT	PMT = 100.00	Records the amount of the annual coupon payments.
2. 1 5 I%YR	I%YR = 15.00	Records the yield-to-maturity of 15%.
3. 2 0 N	N = 20.00	Records the number of time periods as 20.
4. 1 0 0 0 FV	FV = 1,000.00	Records the future or face value of the bond.
5. PV	PV = -687.03	Calculates the present value of the bond



0. Bond valuation with interest compounded semiannually:

Because most bonds pay interest semiannually, we will show the conversion required to calculate the current value of such bonds.

**Example:** If the bond described in Section N pays interest semiannually, the calculations will be:

$I_t = \$50, P_n = \$1000, i = 7.5\%, n = 40.$

Keystrokes	Display	Description
Clear the data and select the TVM Menu		
1. 5 0 PMT	PMT = 50.00	Records the amount of the semiannual coupon payments.
2. 7 . 5 I%YR	I%YR = 7.50	Records the semiannual yield-to-maturity of 7.5%.
3. 4 0 N	N = 40.00	Records the number of time periods as 40.
4. 1 0 0 0 FV	FV = 1,000.00	Records the future or face value of the bond.
5. PV	PV = -685.14	Calculates the present value of the bond









