Chapter 5 Mathematics of Finance

5.2 Compound Interest

Compounded Interest

The TI-83/TI-83 Plus/TI-84 Plus are equipped with a `TVM Solver`. This can be found on the TI-83 by pressing **2nd** **x⁻¹** **ENTER** and on the TI-83 Plus/TI-84 Plus by pressing **APPS** **1** **ENTER**. *TVM* stands for *time-value-of-money*. This solver will be handy throughout Chapter 5 of your text. There are also several financial commands available, many of which are discussed below. (Note: On the TI-83/TI-83 Plus/TI-84 Plus, it is very important to remember that these financial commands cannot be used until values have been entered for the variables in the `TVM Solver`.)

If you are using the TI-83/TI-83 Plus/TI-84 Plus, the variables are as follows:

N   Number of payment periods.
`I%`   The percentage rate, given as a percent.
`PV`   The present value of the account. If money is being paid *into* the account, `PV` is entered as a negative number; otherwise, `PV` is entered as a positive number.
`PMT`   The amount of each payment; if money is being paid *out*, `PMT` is entered as a negative number; if money is being *earned* or *received*, then `PMT` is entered as a positive number.
`FV`   Future value of the account.
`P/Y`   Number of payments per year.
`C/Y`   Number of compoundings per year.

On the TI-83/TI-83 Plus/TI-84 Plus, you will also see the line `PMT:END BEGIN`. If payments are paid at the end of the compounding period, choose `END`. If payments are made at the beginning of the compounding period, as is the case in many annuity problems, choose `BEGIN`.

On the Casio *fx*-9750GII and *fx*-9860GII the financial commands are found by choosing **TVM FF** from the main **MENU.** Select **F2 (CMPD)** to see the list of variables.

Example 2 of this section of the text can solved with the TI-83/TI-83 Plus/TI-84 Plus by entering the values shown in Figure 1:

```
N=6
I%=8.31
PV=-1000
PMT=0
FV=0
P/Y=1
C/Y=1
PMT:END BEGIN
```

Figure 1

In part (a), we are being asked to find the future value, *A* of the account. To do this with the TI-83/TI-83 Plus/TI-84 Plus solver, use the arrow keys to move the cursor beside `FV` and press **ALPHA** **ENTER** to execute the `SOLVE` command. (See Figure 2.)

```
N=6
I%=8.31
PV=-1000
PMT=0
▪FV=1614.400692
P/Y=1
C/Y=1
PMT:END BEGIN
```
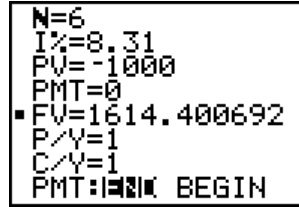
Figure 2

With the Casio *fx*-9750GII and *fx*-9860GII enter TVM FF from the **MENU** and press **F2** (CMPD) for compound interest. Enter the values leaving the FV value at 0. Press **F5** (FV) and see the results of the future value. (See Figure 3)
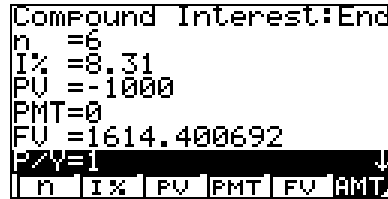
```
Compound Interest:End
n  =6
I% =8.31
PV =-1000
PMT=0
FV =1614.400692
P/Y=1
 n  I% PV PMT FV AMT
```

Figure 3

Note: *Often, the calculator's answers will differ slightly from those of the book because of the amount of precision used during calculation.*

Entering Values in a Table

You can enter values individually in the **TABLE** on the TI-83/TI-83 Plus/TI-84 Plus, On the TI-83/TI-83 Plus/TI-84 Plus access the TblSet menu by pressing **2ⁿᵈ** **WINDOW** and highlight Ask for

Indpnt. To calculate the various effective rates in **Example 4** of the text, enter $\left(1+\dfrac{.043}{x}\right)^{x}-1$ into the

equation editor (be sure to clear or turn off any other functions in the equation editor) go to the Table and enter the individual values. (See Figure 4.)

```
 X  │ Y₁
────┼──────
 1  │ .043
 2  │ .04346
 4  │ .0437
 6  │ .04378
 8  │ .04382
 10 │ .04384
 12 │ .04386
────┴──────
X=1
```

Figure 4

With the Casio *fx*-9750GII and *fx*-9860GII, select **TABLE** from the **MENU** and enter the

expression, $(1+\dfrac{.043}{x})^{x}-1$ into the equation editor. Press **EXE** and then **F5** (SET), set Start at 2,

End at 12 and Step at 2. Press **EXIT** and then **F6** (TABL). (See Figure 5.)

Figure 5

Effective Interest Rate (APY)

Other commands in the `FINANCE` menu of the TI-83/TI-83 Plus/TI-84 Plus can be helpful in this section. The `Eff` command can be used to find the effective rate in **Example 9**. From the home screen of the TI-83, press `2ⁿᵈ` `x⁻¹` and choose option `C` (by pressing `ALPHA` `PRGM`). On the TI-83 Plus/TI-84 Plus, press `APPS` `1` and choose option `C`. Type in the rate of compounded interest, *as a percent*, followed by a comma, then the number of compoundings per year. Press `ENTER` to complete the command. (See Figure 6)
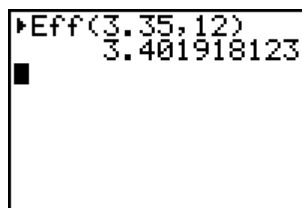
Figure 6
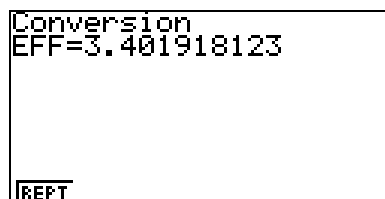
Figure 7

With the Casio *fx*-9750GII and *fx*-9860GII, enter the `FINANCE` menu and choose `F5` (Conversion). Enter the number of compounding periods for `n` and the interest rate for `i%`. Press `F1` (åEFF). (See Figure 7.)

Present Value of an Account

Example 12 can also be solved with the `TVM Solver`. Set `N` = 18, `I%` = 6, `PV` = 0 (since it is unknown), `PMT = 0` (no additional payments will be made into the account), `FV = 15000`, `P/Y = 2`, `C/Y = 2` (since interest is compounded semiannually), and choose `END`. If you are using the TI-83/TI-83 Plus/TI-84 Plus, move the cursor beside PV and press `ALPHA` `ENTER` to find the amount to be deposited. (See Figure 8.)
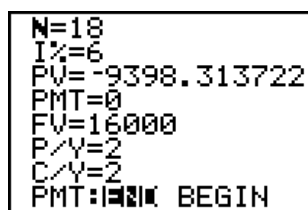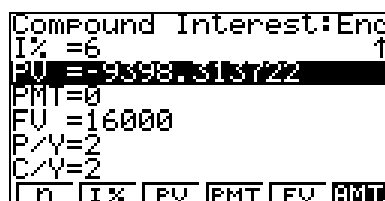

Figure 8

Figure 9

Using the Casio *fx*-9759GII or *fx*-9860GII, enter the `TVM FF` mode and press `F2`(CMPD), enter the values as stated in the previous paragraph and the press `F3`(PV) to find the present value. (See Figure 9.)

5.3 Annuities

Ordinary Annuities

By entering the values shown in Figure 10, and solving for FV, the future value of the annuity in **Example 2** of this section can be determined.
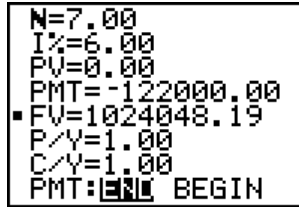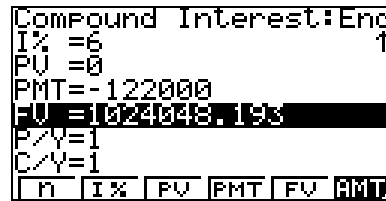

Figure 10

Figure 11

The same problem can be solved on the Casio *fx*-9750GII or *fx*-9860GII, by entering the values into the compound interest mode of the TVM FF. Press F5(FV). (See Figure 11)

To solve **Example 6** with the TI-83/TI-83 Plus/TI-84 Plus, set N = 12×20 = 240, I% = 0, PV = 0 (since it is unknown), PMT = -200, FV = 100000, P/Y = 12, C/Y = 12 (since interest is compounded monthly), and choose END. Solve for I%. (See Figure 12.)
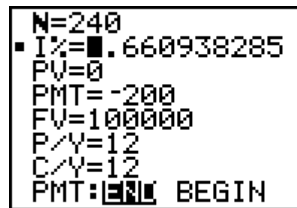

Figure 12

The Casio *fx*-9750GII or *fx*-9860GII can find the interest in a similar manner. Enter the given values into the compound interest menu and press F2(I%) to solve for the interest. (See Figure 13.)
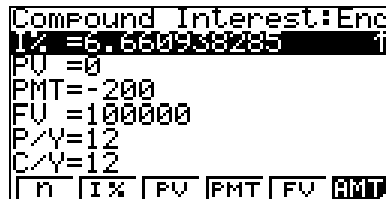

Figure 13

Annuities Due

To solve this type of problem, select **BEGIN** in the TVM Solver menu on the TI-83/TI-84. For instance, Figure 14 represents **Example 7** of the text:
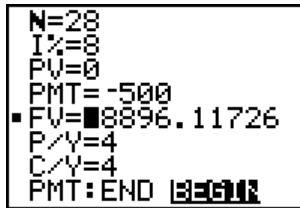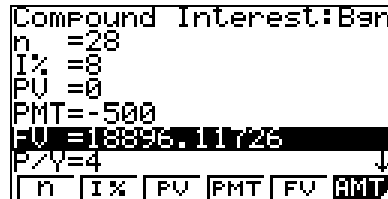
Figure 14

Figure 15

Using the Casio *fx*-9759GII or *fx*-9860GII, go to setup by pressing **SHIFT** **MENU** and choosing **F1** (BGN) for Payment to change the payment to the beginning. Next, enter the TVM mode and choose **F2** (CMPD). Enter the values as given above, leaving FV as 0. Press **F5** (FV) to see the future value. (See Figure 15.)

5.4 Present Value of an Annuity; Amortization

Present Value of an Annuity

The TVM Solver can again be used to perform the calculations necessary in this section of the text. To solve **Example 4**, enter the values shown in Figure 16. Note that FV is set equal to 0. Solve for PV.
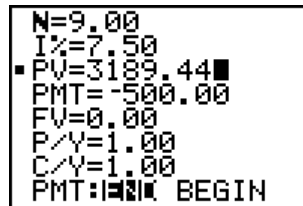

Figure 16

The **TVM FF** mode of the Casio *fx*-9750GII or *fx*-9860GII can be used to solve for present value. Enter the values shown in Figure 17, and press **F3** (PV). (See Figure 18.) Make sure the payment has been set for END in the SET UP function of the calculator.
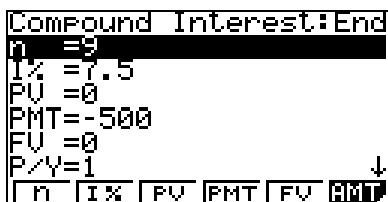

Figure 17

Figure 18

Amortization

The TVM Solver and other financial functions of the TI-83/TI-83 Plus/TI-84 Plus can be used to calculate the amount of the periodic payments required to amortize a loan, as well as other information. To complete **Example 7(a)** set N = 12×30 = 360, I% = 6.7, PV = 110000 (the size of the mortgage), PMT = 0 (since this is unknown), FV = 0, P/Y = 12, C/Y = 12 (since interest is compounded monthly), and choose END. Solve for PMT to see that the payment size needs to be $709.80 per month in order to pay off the mortgage in 30 years. (See Figure 19.)
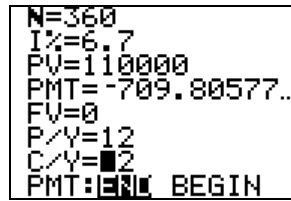
```
N=360
I%=6.7
PV=110000
PMT=-709.80577…
FV=0
P/Y=12
C/Y=■2
PMT:END BEGIN
```
Figure 19

Using the Casio *fx*-9750GII or *fx*-9860GII, enter the TVM FF mode and press F2 (CMPD). (See Figure 20.) Press F4 (PMT) to see the payment. (See Figure 21.)

```
Compound Interest:End
n  =360
I% =6.7
PV =110000
PMT=0
FV =0
P/Y=12
 n   I%  PV  PMT  FV  AMT
```
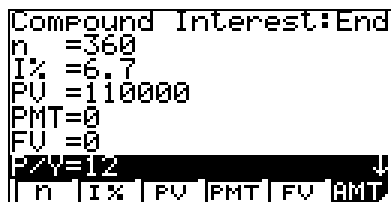Figure 20

```
Compound Interest
PMT=-709.8057758




REPT      AMT      GRPH
```
Figure 21

To find the remaining balance on the loan at any given payment, required in **Example 8(b)**, we can use the bal function on the TI-83/TI-83 Plus/TI-84 Plus. First verify that the payment is $88.85 using the TVM Solver. From the home screen, press 2ⁿᵈ x⁻¹ on the TI-83 or APPS 1 on the TI-83 Plus/TI-84 Plus to obtain the FINANCE menu, and select option 9. Enter the payment number, in this case, 5, and press ENTER. (See Figure 22.)
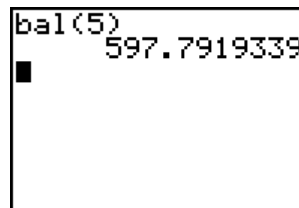
```
bal(5)
         597.7919339
■
```
Figure 22

Using the Casio *fx*-9750GII or *fx*-9860GII, from the **TVM FF** mode, press F2(CMPD)and enter the values from the problem to verify the payment amount is $88.85. Press F6 (AMT), Enter 1 for PM1 and 5 for PM2. (See Figure 23.) Press F1 (BAL) to see the remaining balance. (See Figure 24.)
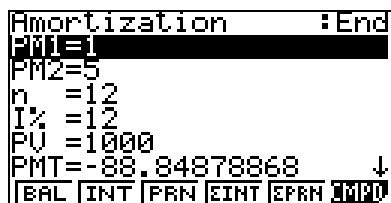
```
Amortization      :End
PM1=1
PM2=5
n  =12
I% =12
PV =1000
PMT=-88.84878868    ↓
BAL INT PRN ΣINT ΣPRN CMPD
```
Figure 23

```
Amortization      :End
BAL=597.7919339




REPT      CMPD      GRPH
```
Figure 24