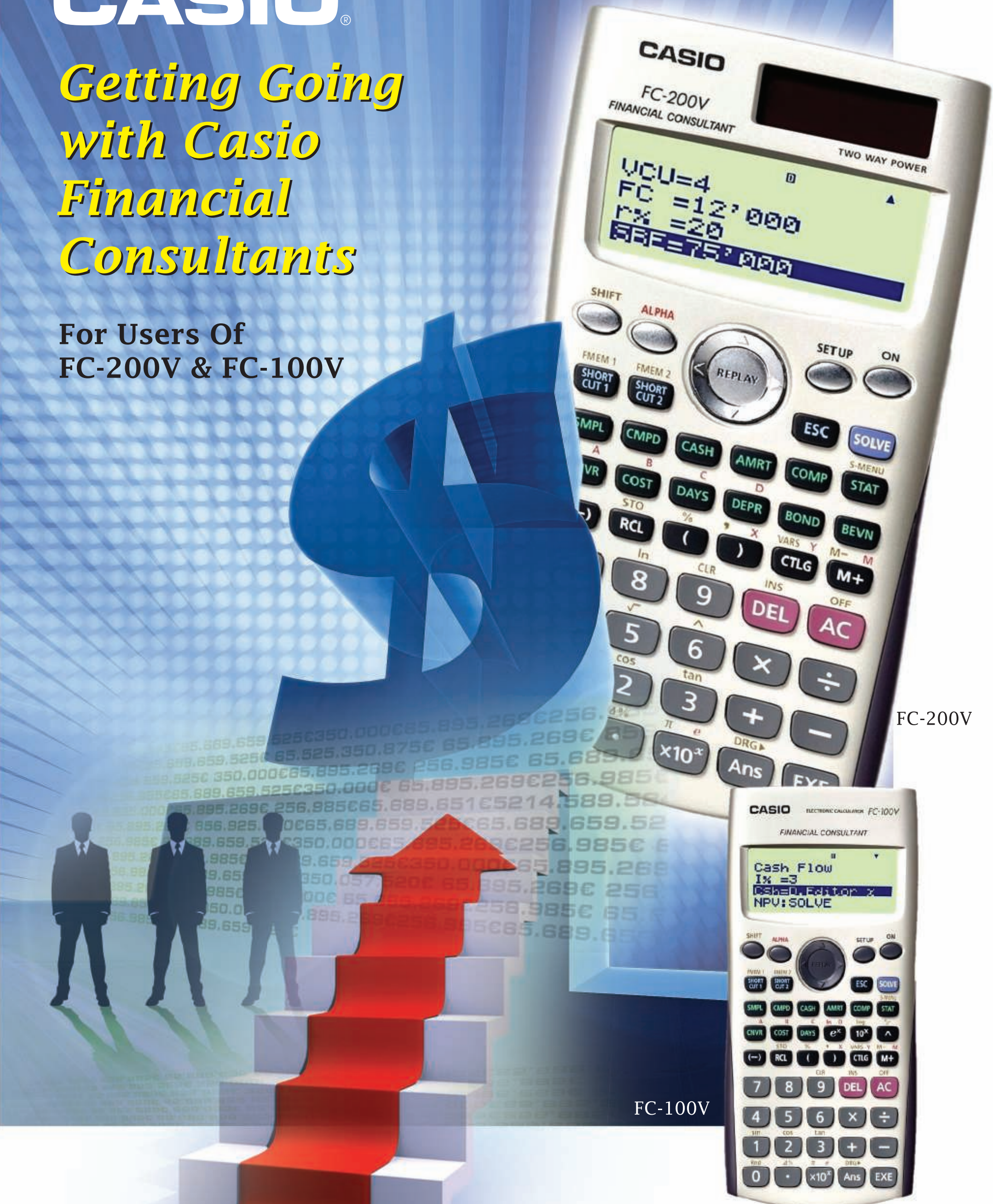
CASIO

Getting Going with Casio Financial Consultants

For Users Of FC-200V & FC-100V



FC-200V

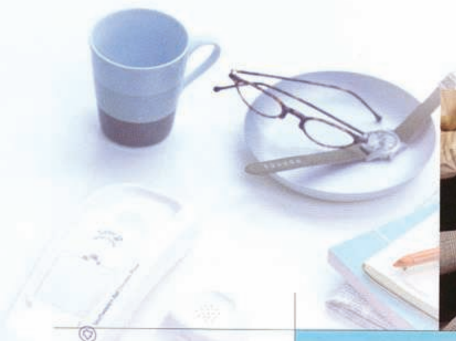
FC-100V

What's Inside:

- *48 solved examples with simulated screens*
- *Tips on setting up your calculator*
- *Practice exercises to enhance your mastery*
- *Calculating statistics on the FC-V series*

A diverse selection of calculation functions to support financial and accounting personnel at every level of expertise.

The CASIO Financial Consultant enables everyone from veterans to beginners in the financial and accounting fields to perform complicated calculations — including investment appraisal, break-even point and depreciation calculations — quickly and easily. You find your answer through a simple three-step process: Just retrieve the calculation formula with the touch of a single button, input the appropriate figures and call up the results. There's no need for troublesome inputting of equations or aggregation. And the compact design makes the Financial Consultant easy to carry with you wherever you go. It's the one calculator that meets all the calculation needs of both financial and accounting experts and newcomers to the industry.



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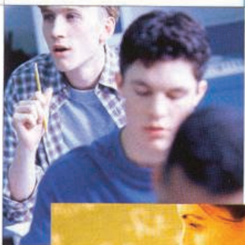

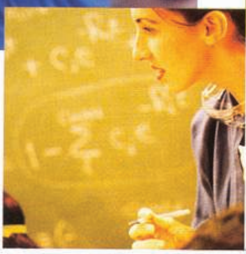

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***Getting Going With Casio Financial Consultants**:*
For Users of FC-200V and FC-100V

This publication is authored by QED Education Scientific Sdn Bhd with supports provided by Marco Corporation (M) Sdn Bhd.

Cover design by ZERO to ONE IDEA.

ISBN 978-983-44179-0-1

Published by
Marco Corporation (M) Sdn Bhd
2, 2nd Floor, Jalan Segambut,
51200, Kuala Lumpur,
Malaysia.

MOTIVATION

Welcome to the world of **CASIO Financial Consultant**.

Many financial professionals, bankers and students expressed to us about how they wish there is a book for them to quickly get to grips with their Casio FC-100V and FC-200V. This motivates us to write this book: 48 examples on various financial calculations to enrich your experience in mastering the calculators.

The examples are chosen to illustrate how to work out a range of financial calculations on the calculators. We do not discuss the underlying financial theories of the examples and assumed that users are already familiar with them.

The FC-200V is an extended version of the FC-100V. Key press sequences for all financial modes in both models are similar, with the exception to Bond, Depreciation and Break-Even, which are functions only available in the FC-200V. Users of both models should find all examples work well with their calculators.

We have referred to the following for inspiration:

- *Schaum's Outlines on Mathematics of Finance* and *Financial Management*
- *Financial Activity for TVM*, Casio Online Resources
- *Mathematics With A Graphics Calculator*, Barry Kissane and Marion Kemp

There are bound to be mistakes in the book despite the fact that we have proof-read it several times. This is the responsibility of the authors and nobody else. On the other hand, the examples provided here illustrate the capabilities of the FC-V series but no more. Various aspects in real financial situations such as taxation liabilities are not considered here. Neither we nor the publisher will be held responsible for any financial decision made based on these examples.

Last but not least, we would like to thank the calculator division of Marco Corporation (M) Sdn. Bhd. for their unwavering support.

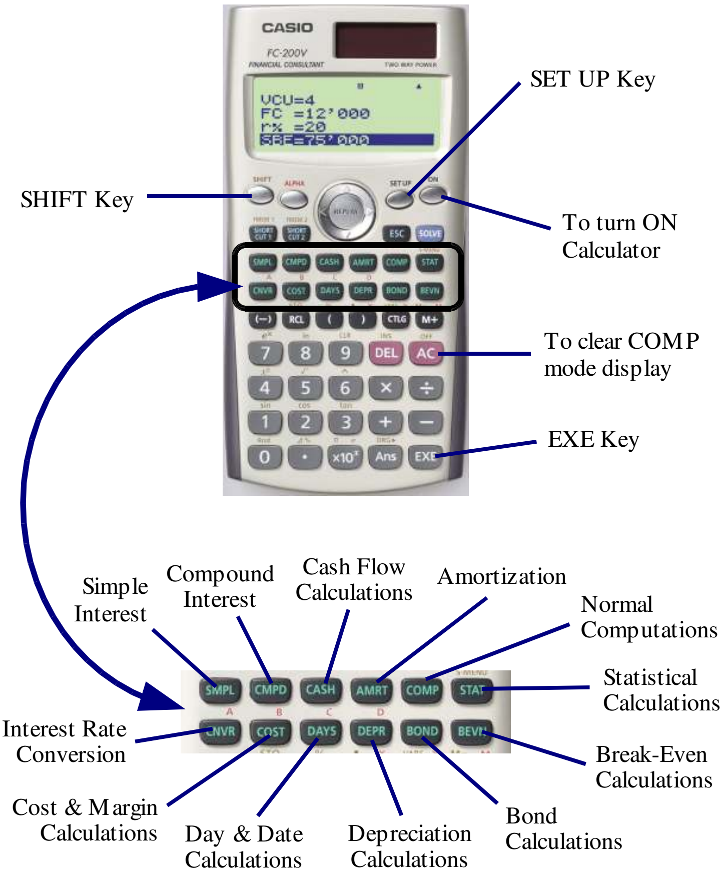
Mun Chou, Fong
For QED Education Scientific Sdn. Bhd.

CONTENTS

1 Getting Started With COMP and SMPL

Introduction To The Keyboard

Let's begin with the graphics of FC-200V's keyboard, with descriptions of certain important keys and all the direct mode access keys. Keyboard layout of FC-100V is similar but without the **BOND**, **DEPR** and **BEVN** mode access keys.



Initializing The Calculator

It is not necessary to initialize the calculator each time you turn it on, as you may have configured it with settings which you prefer, and initializing the calculator will reset all these. It is however an efficient way to set the calculator to its default settings. The initialization can be performed as follow.

- Enter memory setting mode.

  [SHIFT] [9]

- Scroll down to select [**All:EXE**], and execute to initialize.

  [▼] [▼] [EXE] [EXE]

```
            D
  Reset All
Press [AC] key
```

Press [AC] to clear screen. You can also opt to reset just the calculator memory but retain the settings, stored values of financial calculation variables, and so on.

- Enter memory setting mode, scroll to select [**Memory:EXE**] to clear the memory.

  [SHIFT] [9] [▼] [EXE] [EXE]

```
            D
  Complete!
Press [AC] key
```

All data stored in A~D, X, Y, M and answer memory are now reset to 0. Similarly, you can reset the setup, financial calculation variables, and data editor.

Performing Calculations In COMP

Let's get started using the FC-100V/200V with examples on normal scientific computation at **COMP** mode as this is surely one of the most used areas of the calculator. Some of these solved examples will demonstrate a few operational differences between the FC-200V and the FC-100V.

EXAMPLE 1.1 Evaluate 7^4 - 5

SOLUTION:

[For FC-200V]

- Make sure the calculator is in **COMP** mode, and then evaluate the expression.

  [COMP] [7] [SHIFT] [6] [4] [)] [−] [5] [EXE]

```
7^(4)-5      D

          2396
```

[For FC-100V]

- Access **COMP** mode of FC-100V, and then evaluate the expression.

  COMP 7 ^ 4) − 5 EXE

The result obtained should be the same as above. **QED■**

EXAMPLE 1.2 The original selling price of an item is $362.70. The shop owner says that after a 37% discount, you only need to pay $228.50. Cross check whether his mathematics is correct.

SOLUTION:
One way to check is by using the formula

$$Price_{New} = Price_{Old} - Price_{Old} \times Discount$$

- Ensure the calculator is in **COMP** mode, and then key in the following.

  COMP 3 6 2 • 7 − 3 6 2
  • 7 × 3 7 SHIFT (EXE

```
D
362.7-362.7×37%
        228.501
```

So the exact price after the discount should be $228.501, implying that the shop owner is indeed giving you a fair price.

Another nice way to cross check is by using the percentage difference function.

- COMP 2 2 8 • 5
  − 3 6 2 • 7 SHIFT •

```
D
228.5-362.7Δ%
   -37.00027571
```

This method shows that the discount given is just slightly more than 37%. Both approaches imply that while his mathematics is not exact, the shop owner is a scrupulous merchant. **QED■**

One useful feature of the FC-100V/200V is the expression editing, which allows you to correct, make insertion into, or delete part of the expression.

EXAMPLE 1.3 Evaluate the following expressions from (a) to (c) by using suitable expression editing operations: (a) $7.4^{3.8}$, (b) $7.4^{3.85}$, (c) $7.9^{3.85}$.

SOLUTION:

[For FC-200V]

- Access **COMP** mode and key in the following to find $7.4^{3.8}$.

  COMP 7 • 4 SHIFT 6 3 • 8 EXE

```
D
7.4^(3.8
      2009.465411
```

So $7.4^{3.8}$ is ≈ 2009.465. You can now edit the same expression to evaluate $7.4^{3.85}$.

- Right after the above, press ◀ once to place cursor at the position after '8', and find $7.4^{3.85}$ with

  5 EXE

```
D
7.4^(3.85
      2220.967078
```

- Now use ◀ ▶ to move cursor to the position after '4', and find $7.9^{3.85}$ with

  DEL 9 EXE

```
D
7.9^(3.85
      2856.697807
```

[For FC-100V]

- At the FC-100V, there is a slight difference in entering the expression.

  COMP 7 • 4 ^ 3 • 8 EXE

The rest of the editing operations are similar to that of FC-200V. **QED■**

Get Acquainted With The User Interface

The menu interface of the FC-100V/200V is quite intuitive and having a sense of how it works is the key in mastering the calculator. The next two examples should demonstrate preliminary ideas about how to interact with the interface effectively.

EXAMPLE 1.4 Use exact calculation to find number of days between Dec 10, 2004 and Jan 26, 2005.

SOLUTION:

While a look up the normal calendar should resolve this easily, you can solve this efficiently at the **DAYS** mode of the calculator.

- Enter **DAYS** mode with DAYS .

- Is the screen displaying [**Set:365**]? If yes, leave it alone. Otherwise, set it so with EXE 2 .

- Scroll to select [**d1**] with ▼, then key in the first date of 12/10/2004. (M/D/Y)

  1 2 1 0 2 0 0 4 EXE

```
                D
Days Calc.
Set =365
d1  =12102004
d2  =01012004
```

- Key in the second date of 01/26/2005. (M/D/Y)

  0 1 2 6 2 0 0 5 EXE

```
                D
Set =365
d1  =12102004
d2  =01262005
Dys =47
```

- Now with [**Dys**] selected, press SOLVE .

The number of days between these two dates is therefore 47. **QED**■

EXAMPLE 1.5 Now use exact calculation to find the date which falls 65 days prior to Jan 10, 2005.

SOLUTION:

- Enter **DAYS** mode with DAYS . Make sure Date Mode is displaying [**Set:365**] with EXE 2 .

- Scroll down to select [**d2**] and enter the date of 01/10/2005. Leave [**d1**] alone for now.

  ▼ ▼ 0 1 1 0
  2 0 0 5 EXE

```
                D
Days Calc.
Set =365
d1  =01012004
d2  =01102005
```

- Key in 65 for [**Dys**], and then scroll up to highlight [**d1**] and solve it.

  6 5 EXE ▲ ▲ SOLVE

```
                D
Set =365
d1  =11062004
d2  =01102005
Dys =65
```

Therefore, 65 days prior to Jan 10, 2005 is Nov 6, 2004. **QED**■

The next example is a simple problem of cost, pricing and profit margin which serves to present the flexibility of FC-100V/200V's interface.

EXAMPLE 1.6 The cost of each carton of shampoos is \$54.24. The brand manager aims to attain 55% gross profit margin per carton. Find the selling price.

SOLUTION:
Let's use the **COST** mode to aid us here.

- Access **COST** mode with COST. With [**CST=0**] selected, press
  5 4 • 2 4 EXE

```
Cst/Sel/Mrg
CST =54.24
SEL =0
MRG =55
```

- Scroll to [**MRG**] and key in the margin of 55%.
  ▼ 5 5 EXE

- Scroll up to select [**SEL**], and then solve for the selling price.
  ▲ SOLVE

```
Cst/Sel/Mrg
CST =54.24
SEL =120.5333333
MRG =55
```

The output implies that the manager should price each carton at \$120.54 to achieve the gross profit margin of 55%. **QED**■

The SETUP Mode

An important feature of FC-100V/200V is the **SETUP**, where you manage various aspects of the interface. Six useful settings that you could manage are discussed here. We advise that you practice on these examples in one go, starting with Example 1.7. Do note that the simulated screens shown are that of FC-200V.

EXAMPLE 1.7 Setting 360-day year as default.

SOLUTION:
The calculator's default for day calculation uses the 365-day year. If you do use the 360-day year frequently, you can set this as your default.

- Turn on the calculator and press SETUP.

- [▼] to select [**Date Mode:365**], and then you tap [EXE] [1]

```
  360      D
Payment:End
Date Mode:360
dn:CI
Periods/Y:Annu
```

The '360' indicator is turned on, indicating the 360-day year is the current setting. You can easily revert to the 365-day year with similar operations. In this book we use 365-day year in all our examples. **QED■**

EXAMPLE 1.8 Setting date input format.

SOLUTION:
In Examples 1.4 and 1.5, you were entering dates using Month/Day/Year format. If the Day/Month/Year format is your preference, you can set the input format as so.

- While still in **SETUP**, scroll down with [▼] to select [**Date Input:MDY**], and then [EXE] [2]

```
  360   DMY D
dn:CI
Periods/Y:Annu
Bond Date:Date
Date Input:DMY
```

The 'DMY' indicator is lit, indicating the current status of the date input format. In this book we assume the default Month/Day/Year format. **QED■**

EXAMPLE 1.9 Setting interest calculation type for odd/partial month.

SOLUTION:
If the interest calculation involves a period with partial month such as 6 months and 12 days, you can set the interest calculation type for that partial month either as compound calculation or simple calculation.

- Use [▲] [▼] to select [**dn:CI**], and then set this option to simple interest with [EXE] [2]

```
  360 SI DMY D
Payment:End
Date Mode:360
dn:SI
Periods/Y:Annu
```

It is reasonable to say that partial month interest computed with simple interest will be less than what is computed with compound interest. **QED■**

EXAMPLE 1.10 Turning on the 3-digit separator (thousands separator.)

SOLUTION:
If you want to display the 3-digit comma separator, you can turn this feature on and set the comma as superscript or subscript. In this example you shall set the separating comma as subscript.

- While still in **SETUP**, scroll down with ▼ to select [**Digit Sep.:Off**], and then press EXE 2

```
360 SI DMY D
Date Input:DMY
PRF/Ratio:PRF
B-Even:Quantity
Digit Sep.:Sub
```

The comma separator works in all modes except for **COMP** mode and **STAT** mode. The subscript separator is turned on throughout this book from hereon. **QED■**

EXAMPLE 1.11 Setting number of decimal places.

SOLUTION:
You can set the number of decimal places of a number, where it is rounded off to the specified number of decimal places. Let's set it to 2 here.

- Scroll to select [**Fix:Off**], and set it to 2 with EXE 2

```
360 SI DMY D    FIX
Angle:Deg
Fix:2
Sci:Off
Norm:Off
```

We will not use this feature in this book, but we strongly suggest that you set it to 2 or 3 for your actual daily use. **QED■**

EXAMPLE 1.12 Setting screen contrast.

SOLUTION:
- Scroll to highlight [**CONTRAST:EXE**], and then press EXE. Use ◀ ▶ to control screen contrast.

```
360 SI DMY D    FIX
CONTRAST

LIGHT           DARK
 [◀]             [▶]
```

When you done, you could return to **SETUP** with ESC. **QED■**

Simple Interest With SMPL

Calculating simple interest is a straight forward exercise. The future value is determined by computing the product of the present value, interest rate and interest period. At the FC-100V/200V, the simple interest, **SI**, and the future value, **SFV**, can be determined easily. Day calculation can be set to *exact* or *approximated*, and in this book we assume exact day calculation is used in all examples.

EXAMPLE 1.13 Find the exact simple interest, on a 60-day loan of $1,500.00 at 14½%. Assume you are the borrower of this loan.

SOLUTION:
It is clear that the loan period **Dys**, in days, is 60, the interest rate **I%** is 14.5, and the present value **PV** is 1,500. You should enter these values accordingly. Your goal is to solve for **SI**.

- Press SMPL to enter **SMPL** mode. If day calculation is [**Set:365**], let it be; otherwise, press EXE 2.

- Scroll down and enter the known values given to the 3 variables.

  ▼ 6 0 EXE 1 4 • 5 EXE
  1 5 0 0 EXE

```
                D
Dys =60
I%  =14.5
PV  =1,500
SI  :Solve
```

- With [**SI :Solve**] selected, tap SOLVE.

```
                D
SI  =-35.75342466
```

The interest is thus approximately $35.75. The minus sign implies that this is a payment to you, which in this case is the interest accrued on the loan. **QED**■

EXAMPLE 1.14 When Jon's wife hire-purchased her first car, she took out a 5-year loan of $30,000 at 3.3%. She wanted to find out what her monthly repayment would be and decided to use the Casio FC-V calculator.

SOLUTION:
It is obvious that **Dys** = 5×365, **I%** = 3.3 and **PV** = 30,000. The first task is to find the future value, **SFV**.

- Tap [SMPL] to access **SMPL** mode. Make sure day calculation is set to [**Set: 365**]; otherwise, press [EXE] [2] to set it so.

- Scroll down and key in all the known values.

  [▼] [5] [×] [3] [6] [5] [EXE] [3]
  [•] [3] [EXE] [3] [0] [0] [0] [0] [EXE]

```
                    D
Dys =1,825
I%  =3.3
PV  =30,000
SI  :Solve
```

- Scroll to select [**SFV:Solve**] and solve for the future value of this car loan.

  [▼] [SOLVE]

```
                    D
SFV =-34,950
```

To find the monthly repayment, you should divide **SFV** with 60 months (the total months in 5 years.) An efficient way is through the use of answer memory, [Ans], where it was updated when you last pressed the [EXE] key. At this point the answer memory is storing the value of **SFV**, and you should therefore do this next step right after solving for **SFV** in **SMPL** mode.

- Access **COMP** and find the monthly repayment.

  [COMP] [Ans] [÷] [6] [0] [EXE]

```
                    D
Ans÷60

               -582.5
```

Obviously, she will be $582.50 poorer every month for the next 5 years. **QED■**

This last step of using the answer memory may seem trivial, but it is very useful when the answer is long and you need it in the next calculation. The answer memory is also useful when the calculated result is used recursively.

Using SHORTCUT Keys

The two SHORTCUT keys can be configured to get instant access to calculations which are performed frequently. The configuration can be a mode with specific settings, a value or an expression.

In the previous example you calculated the monthly repayment of Jon's wife’s car loan. Suppose her banker always uses the same values in his calculation, altering only the present value. He could configure SHORTCUT 1 as **SMPL** mode stored with these values, and configure SHORTCUT 2 to calculate the monthly repayment, assuming the loan period is always 5 years.

EXAMPLE 1.15 Configure SHORTCUT 1 as **SMPL** mode with values given in Example 1.14, and set it ready to take in new **PV**. Then, configure SHORTCUT 2 to calculate monthly repayment of the 5-year loan.

SOLUTION:
First recall that parameters with fixed-value are **Dys** = 1,825 and **I%** = 3.3.

- Access **SMPL** mode and key in these fixed-values.

  [SMPL] [▼] [1] [8] [2] [5] [EXE]
  [3] [•] [3] [EXE]

```
                          D
Dys =1,825
I%  =3.3
PV  =0
SI  :Solve
```

- With [**PV**] selected, press

  [SHIFT] [RCL] [EXE] [EXE]

SHORTCUT 1 is now configured. When you access it, the calculator enters **SMPL** mode with the above settings. The next step is to assign the expression 'Ans÷60' to SHORTCUT 2.

- Access **COMP** mode, enter the expression and assign it to SHORTCUT 2.

  [COMP] [Ans] [÷] [6] [0] [SHIFT] [RCL] [▼] [EXE] [EXE]

```
                          D
Ans÷60

                             0
```

SHORTCUT 2 is now assigned with the expression 'Ans÷600'. **QED■**

EXAMPLE 1.16 Redo Example 1.14 with a 5-year loan of 40,000, using the SHORTCUT keys just configured in previous example.

SOLUTION:
The solution process would now be much simpler with the SHORTCUT keys.

- Enter SHORTCUT 1, key in the present value, and find the corresponding future value.

  [SHORTCUT 1] [4] [0] [0] [0] [0] [EXE] [▼] [EXE]

```
                          D
SFV =-46,600
```

- Use SHORTCUT 2 to find the monthly installment of the loan.

  SHORT CUT 2 EXE

```
              D
Ans÷60

   -776.6666667
```

The monthly installment of the 5-year car loan of $40,000 is thus $776.67. **QED■**

Exercises

The purpose of the exercises is to enhance your mastery of the calculator.

1. Turn on the frequency column of **STAT** mode editor.

2. Use exact calculation to find the date which falls 77 days after Jan 15, 2008.

3. The price of a shirt is advertised as $98.50 and is sold for $68.95. What is the discount as a percentage of the cost price?

4. A Mexican restaurant's *Weekender Set* is priced at $38.90 + 17% Goods and Services Tax. What is the actual amount paid by Raul if he orders two sets?

5. What is the total exact simple interest of a 180-day loan of $15,000 at 6.25%.?

6. Find the total interest earnings for the 3-year investment of $5,000 in an investment vehicle which yields return of 7.2% compounded annually.

2 Calculating With CMPD and AMRT

Compound Interest Calculations With CMPD

The intuitive interface of FC-100V/200V makes your task of working on compound interest problems much less tedious. In this chapter, partial month situation is calculated using compound interest, payment is assumed to be made at the end of the payment term/date, and the symbol j_m is used to represent the nominal interest rate that is compounded m times a year.

First you should set the partial month calculation to compound interest calculation before begin working on the examples.

EXAMPLE 2.1 Set partial month to CI.

SOLUTION:

- Press [SETUP] to access **SETUP**. If you see [**dn:CI**], then leave it as such. Otherwise, press

  [▼] [▼] [EXE] [1]

```
              D
Payment:End
Date Mode:365
dn:CI
Periods/Y:Annu
```

The calculator's partial month is now set to compound interest calculation. **QED■**

EXAMPLE 2.2 Set payment to take place at the end of the compound term.

SOLUTION:

In certain financial situations, payment is made at the start of each compound term. However, in this chapter the assumption is that all payments are made at the end of each compound term.

- Press [SETUP] [EXE] [2]

```
              D
Payment:End
Date Mode:365
dn:CI
Periods/Y:Annu
```

So the payment date is now set to be at the end of each compound period. **QED■**

EXAMPLE 2.3 Find the compound interest on $1,000 for 2 years at 12% compounded semi-annually, or $j_2 = 12\%$.

SOLUTION:
In **CMPD** mode, **n** normally denotes the number of payment (or deposit) period, **PMT** is the payment per term, **FV** is the future value (principal and interest), **P/Y** is the number of annual payment, while **C/Y** is the number of compound period per year. You can find out more at page E-45 of the User's Guide.

The situation of this problem is akin to that of a certificate of deposit (CD) where deposit term **n** = 2, **I%** = 12, **C/Y** = 2 as interest is compounded semi-annually, and **P/Y** = 1 since there is no monthly payment involved. The goal is to find **FV**.

- Access **CMPD** mode and key in all the known values given at the problem statement.

  CMPD

  ▼ 2 EXE 1 2 EXE

  (−) 1 0 0 0 EXE

  0 EXE ▼ 1 EXE 2 EXE

```
                D
n    =2
I%   =12
PV   =-1,000
PMT  =0
```

```
                D
PMT  =0
FV   =0
P/Y  =1
C/Y  =2
```

- Scroll up to select [**FV**] and solve it.

  ▲ ▲ SOLVE

```
                D
PMT  =0
FV   =1,262.47696
P/Y  =1
C/Y  =2
```

So the future value is approximately $1,262.48. Obviously the compound interest accrued is $1,262.48 – $1,000 = $262.48. **QED**■

EXAMPLE 2.4 Calculate for the monthly installment of a 25-year, $100,000 mortgage loan at interest of 6.25% compounded monthly.

SOLUTION:
In this example, the number of payment period **n** = 12×25 = 300, **PV** = -100,000, and **P/Y** is equal to **C/Y**, where both are equal to 12. The main goal of the problem is to find **PMT** when **FV** = 0.

- Access **CMPD** mode and key in all the known values given.

  [CMPD]

  [▼] [1] [2] [×] [2] [5] [EXE]

  [6] [•] [2] [5] [EXE]

  [(−)] [1] [0] [0] [0] [0] [0] [EXE]

  [▼] [0] [EXE] [1] [2] [EXE] [1] [2] [EXE]

```
                D
Set :End
n   =300
I%  =6.25
PV  =-100,000
```

```
                D
PMT =0
FV  =0
P/Y =12
C/Y =12
```

- Scroll up to select [**PMT**] and solve it.

  [▲] [▲] [▲] [SOLVE]

```
                D
PMT =659.6693783
FV  =0
P/Y =12
C/Y =12
```

Therefore, the monthly installment of the mortgage loan is about $659.67. **QED■**

Suppose the mortgage loan presented in Example 2.4 is calculated based on daily interest. The key to finding the corresponding monthly installment would be to just set [**C/Y**] to 365 and then solve for [**PMT**].

EXAMPLE 2.5 Repeat Example 2.4 but this time calculate the monthly installment at interest of 6.25% compounded daily instead.

SOLUTION:

- As all variables should still be retaining the values you have just inputted, access **CMPD** mode, scroll down with [▼] to select [**C/Y**], and then key in

  [3] [6] [5] [EXE]

```
                D
PMT =659.6693783
FV  =0
P/Y =12
C/Y =365
```

- Scroll up to select [**PMT**] and solve it.

  [▲] [▲] [▲] [SOLVE]

```
                D
PMT =660.6443008
FV  =0
P/Y =12
C/Y =365
```

The monthly installment of the mortgage loan with daily interest is approximately $660.64. **QED■**

The **CMPD** mode also allows you to solve for other financial calculation variables, when values of the rest of the variables are given.

EXAMPLE 2.6 The earning per share of the common stock of a company increased from \$4.85 to \$9.12 for the last 5 years. Find the compounded annual rate of increase.

SOLUTION:
This is a simple compound interest problem, where compound period is **n** = 5, **PV** = -4.85, **FV** = 9.12, **PMT** = 0 as no payment was made, and **P/Y** = **C/Y** = 1. The task is to solve for **I%**.

- Access **CMPD** mode and key in all known values.

CMPD ▼ 5 EXE ▼ (–) 4 • 8 5
EXE 0 EXE 9 • 1 2 EXE
1 EXE 1 EXE

```
PMT =0
FV  =9.12
P/Y =1
C/Y =1
```

- Scroll up to select [**I%**] and solve it.

▲ ▲ ▲ ▲ ▲ SOLVE

```
I%  =13.46204842
PV  =-4.85
PMT =0
FV  =9.12
```

Hence the stock of the said company has been increasing for the last 5 years at the compound annual rate of about 13.46%. **QED■**

The last example shows that when sufficient information is provided, you could solve for any of the financial calculation variables contained inside the **CMPD** mode. Such flexibility translates to versatility in problem solving. In the next solved example, the **CMPD** mode is used to model a simple annuity problem.

EXAMPLE 2.7 SK was repaying a debt with payments of \$250 a month. She missed payments for Nov, Dec, Jan and Feb. What payment will be required in March to put her back on schedule, if interest is at $j_{12} = 14.4\%$?

SOLUTION:
This problem can be modeled as a simple annuity problem where **n** = 5 as SK is 5 months behind schedule, **I%** = 14.4, **PMT** = 250, and finally **P/Y** = **C/Y** = 12.

You should let **PV** = 0 as SK did not default her installment until 5 months before. Your job is to determine the future value for the problem.

- Enter **CMPD** and key in all necessary values.

[CMPD] [▼] [5] [EXE] [1] [4] [•] [4] [EXE]
[0] [EXE] [2] [5] [0] [EXE] [▼]
[1] [2] [EXE] [1] [2] [EXE]

```
                 D
PMT =250
FV  =0
P/Y =12
C/Y =12
```

- Scroll up to select [**FV**] and solve it.

[▲] [▲] [SOLVE]

```
                 D
PMT =250
FV  =-1,280.36217
P/Y =12
C/Y =12
```

So in order to get her installment schedule back on track, SK needs to settle $1,280.36 in her March installment. **QED■**

Doing Amortization With AMRT

The **AMRT** mode of FC-100V/200V allows user to perform amortization where it shares many common variables with **CMPD** mode. Such 'sharing' is useful in that you can solve for variable such as **PMT** at **CMPD** before proceeding to **AMRT** for the amortization calculations. Certain amortization problems are actually simple annuity problems which you can solved with the **CMPD** mode as discussed in Example 2.7.

We should begin this section by looking at the definition of certain terms such as **PM1**, **PM2**, **BAL**, **INT**, etc. contained in the **AMRT** mode, with the aid of a couple of illustrations captured from the User's Guide. Understanding these terms is key to using the **AMRT** mode effectively in problem solving. You should look up page E-55 of the User's Guide for more detailed descriptions.

[**PM1**]: The payment named **PM1**, which must be an integer ≥ 1.
[**PM2**]: The payment **PM2**, which must come after **PM1**.
[**BAL**]: Principal balance upon completion of **PM2**, shown in Fig. 2.1 as area *C*.
[**INT**]: Interest portion of **PM1**, shown in Fig. 2.1 as area *A* of the strip.
[**PRN**]: Principal portion of **PM1**, shown in Fig. 2.1 as shaded area *B*.
[**ΣINT**]: Total interest paid from **PM1** to **PM2**, shown in Fig. 2.2 as area *E*.
[**ΣPRN**]: Total principal paid from **PM1** to **PM2**, shown in Fig. 2.2 as area *D*.

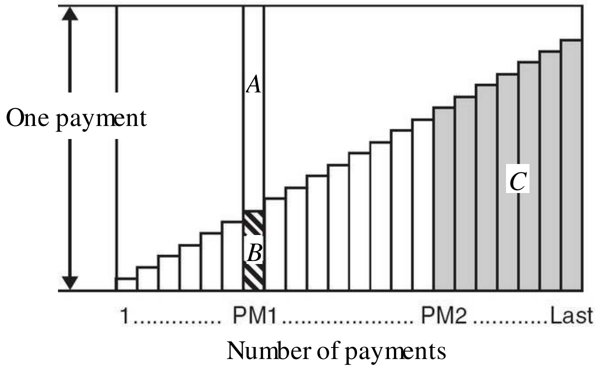


Figure 2.1

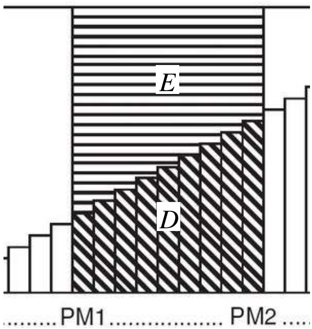
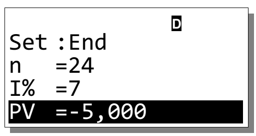


Figure 2.2

EXAMPLE 2.8 A loan of $5,000 is to be amortized with equal monthly payment over 2 years at j_{12} = 7%. Find the outstanding principal after 8 months.

SOLUTION:
The task is to find the principal balance after 8 months(or payments.) First you need to solve for **PMT** (monthly payment) as it is needed for this amortization. So you should begin at **CMPD** with **n** = 2×12 = 24, **I%** = 7, **PV** = -5,000, **FV** = 0, and **P/Y** = **C/Y** = 12.

- Access **CMPD**, key in all known values, and solve for [**PMT**].



[(−)] [5] [0] [0] [0] [EXE] [▼] [0] [EXE]
[1] [2] [EXE] [1] [2] [EXE]
[▲] [▲] [▲] [SOLVE]

```
PMT =223.8628955
FV  =0
P/Y =12
C/Y =12
```

Having determined that **PMT** is roughly $223.86, you should now switch to **AMRT**. To find the principal balance after 8 payments means you must solve **BAL** when **PM2** = 8. For **PM1** you just let it as 1.

- Access **AMRT**, key in the two payments, and then scroll down to solve for [**BAL**].

[AMRT]
[▼] [1] [EXE] [8] [EXE]
[▼] [▼] [▼] [▼] [▼] [▼] [▼]
[SOLVE]

```
Set :End
PM1 =1
PM2 =8
n   =24
```

```
BAL =-3,410.25606
```

Therefore the outstanding principal (or balance) after 8 payments is approximately $3410.26. Press [ESC] to return to **AMRT**. **QED■**

In the last example you could have put other value for **PM1** and still get the same solution, as long as it is an integer ≥1. However, in most circumstances you should always let **PM1** < **PM2** whenever possible. The condition and explanation are given on pages E-57 to E-59 of the User's Guide.

The next solved example is an extension of Example 2.8, and it shows a situation where you can obtain the right solution in spite that **PM1** ≥ **PM2**.

EXAMPLE 2.9 Repeat Example 2.8, but this time find the interest portion and the principal portion of the 9th payment.

SOLUTION:
The task is to solve both **INT** and **PRN**, with **PM1** set as 9. Values of other variables entered in Example 2.8 should be retained.

- Access **AMRT** mode and set **PM1** to 9. All other variables should remain the same.

  AMRT ▽ 9 EXE

```
Amortization
Set :End
PM1 =9
PM2 =8
```

- Scroll to select [**INT**] and solve it.

  ▽ ▽ ▽ ▽ ▽ ▽ ▽
  ▽ ▽ SOLVE

```
INT =19.89316037
```

- Press ESC to return to **AMRT**, and then select [**PRN**] and solve it.

  ▽ SOLVE

```
PRN =203.9697351
```

The interest portion of this 9th payment is approximately $19.90 and the principal portion is approximately $203.97. **QED**■

EXAMPLE 2.10 Lucas borrows $35,000 at j_{12} = 3% to buy a car. The loan should be repaid with monthly installment over three years. Find the total interest paid in the 12 payments of the second year.

SOLUTION:

In other words, the task is to find the total interest paid from payment 13 (first month of second year) until payment 24. Again you begin at **CMPD** with **n** = 3×12 = 36, **I%** = 3, **PV** = -35,000, **FV** = 0, and **P/Y** = **C/Y** = 12.

- Access **CMPD** mode, key in all known values, and solve for [**PMT**].

  CMPD ▽ 3 6 EXE 3 EXE
  (−) 3 5 0 0 0 EXE ▽
  0 EXE 1 2 EXE 1 2 EXE
  △ △ △
  SOLVE

```
Set :End
n   =36
I%  =3
PV  =-35,000
```

```
PMT =1,017.84234
FV  =0
P/Y =12
C/Y =12
```

The monthly installment of the loan is thus approximately $1,017.84.

- Now enter **AMRT**, key in 13 for **PM1** and 24 for **PM2**, and then scroll down to solve for [**ΣINT**].

  AMRT ▼ 1 3 EXE 2 4 EXE
  ▼ ▼ ▼ ▼ ▼
  ▼ ▼ ▼ ▼ ▼
  SOLVE

```
Set :End
PM1 =13
PM2 =24
n   =36
```

```
ΣIN =550.9318648
```

The interest paid by Lucas in the second year of his loan repayment is $550.93. Tap ESC to return to **AMRT** mode. **QED■**

Interest rate of mortgage tends to change with economic forces, and this affects the total repayment amount, as well as the length of time needed to repay the debt.

EXAMPLE 2.11 QED-Corp issues mortgages where payments are determined by interest rate that prevails on the day the loan is made. The monthly payments do not change although the interest rate varies according to market forces. The duration required to repay the loan will change accordingly as a result of this.

Suppose a person takes out a 20-year, $70,000 mortgage at $j_{12} = 9\%$. After exactly 2 years interest rates change. Find the new duration of the loan and the final smaller payment if the new interest rate stays fixed at $j_{12} = 10\%$.

SOLUTION:
The loan conditions require you to first establish the principal balance after 2 years of installment, and use it to find the new loan duration. The first part of the solution is therefore to solve **PMT** with **n** = 240, **I%** = 9, **PV** = -70,000, **FV** = 0, and **P/Y** = **C/Y** = 12.

- Key in all known values at **CMPD** mode and solve for [**PMT**].

  CMPD ▼ 2 4 0 EXE 9 EXE
  (–) 7 0 0 0 0 EXE ▼ 0 EXE
  1 2 EXE 1 2 EXE ▲ ▲ ▲ SOLVE

```
PMT =629.8081691
FV  =0
P/Y =12
C/Y =12
```

Now that part is settled, you move on to to find the principal balance after 2 years. In this case you want to solve **BAL** when **PM2** = 24. For **PM1** just let it as 1.

- Access **AMRT** mode, key in the two payments, and then scroll down to solve for [**BAL**].

  AMRT

  ▼ 1 EXE 2 4 EXE

  ▼ ▼ ▼ ▼ ▼ ▼ ▼

  SOLVE

```
Set :End
PM1 =1
PM2 =24
n   =240
```

```
BAL =-67,255.2343
```

You have so far established that **PMT** = \$629.81 and the principal balance of the loan **BAL** = \$67,255.23. Now use this principal balance as the new **PV** to find the remaining loan duration, where **PMT** remains at \$629.81 but the interest rate is now at $j_{12} = 10\%$. Keep in mind that the answer memory Ans at this moment stores the value of the principal balance (**BAL**).

- Return to **CMPD** mode, assign the principal balance (**BAL**) to **PV**, and 10 to **I%**.

  CMPD ▼ ▼ 1 0 EXE Ans EXE

```
n   =240
I%  =10
PV  =-67,255.2343
PMT =629.8081691
```

- Scroll up to select [**n**] and solve it.

  ▲ ▲ ▲ SOLVE

```
n   =265.8551734
I%  =10
PV  =-67,255.2343
PMT =629.8081691
```

So there are 265 more full monthly installments, plus a final, smaller payment. In other words the remaining loan duration is 266 months long. Now add that to the 24 months already passed, the new loan duration is thus 24 + 266 = 290 months, or 24 years and 2 months.

The final part of the solution is to determine the final smaller payment. The idea is to find the future value using **n** = 266, and then by subtracting its absolute value from **PMT** should give us the amount of the final payment.

- While still at **CMPD** mode, let **n** = 266 and then solve [**FV**].

  [2] [6] [6] [EXE] [▼] [▼] [▼] [SOLVE]

```
I%  =10
PV  =-67,255.2343
PMT =629.8081691
FV  =-90.88962559
```

- Go to **COMP** mode and calculate **PMT** + **FV**. You can use the answer memory here instead of **FV**.

  [COMP] [Ans] [+] [SHIFT] [CTLG] [▼] [▼] [▼] [EXE] [EXE]

```
Ans+PMT
            538.9185435
```

Here you calculate the sum of **PMT** and **FV** because **FV** is a negative value and the net difference of these values is what you want. So, the amount of the final payment is $538.92. **QED■**

Often borrower would want to re-finance long term loan. Using **CMPD** and **AMRT** in combination, you can easily compare the cost of re-financing with the savings due, to decide whether the re-financing exercise would be profitable.

EXAMPLE 2.12 Livia has an $8,000 loan with QED-Corp which is to be repaid over 4 years at j_{12} = 18%. In case of early repayment, she is to pay a penalty of 3 months' payments. Right after the 20th payment, Livia determines that her banker would lend her the money at j_{12} = 13.5%. Should she re-finance?

SOLUTION:
Similar to previous examples, you begin by finding **PMT** with **n** = 48, **I%** = 18, **PV** = -8,000, **FV** = 0, and **P/Y** = **C/Y** = 12.

- Access **CMPD** and solve for [**PMT**].

  [CMPD] [▼] [4] [8] [EXE] [1] [8] [EXE]
  [(–)] [8] [0] [0] [0] [EXE] [▼] [0] [EXE]
  [1] [2] [EXE] [1] [2] [EXE] [▲] [▲] [▲] [SOLVE]

```
PMT =234.9999969
FV  =0
P/Y =12
C/Y =12
```

Next move to **AMRT** and find the principal balance right after the 20th payment. This would enable you to find the total to be refinanced, and then find the new monthly installment.

- Access **AMRT**, key in 20 for **PM2**, 1 for **PM1**, and then scroll down to solve [**BAL**].

  [AMRT] [▼] [1] [EXE] [2] [0] [EXE]
  [▼] [▼] [▼] [▼] [▼] [▼] [▼]

  [SOLVE]

```
Set :End
PM1 =1
PM2 =20
n   =48
```

```
BAL =-5,340.77836
```

The monthly installment is thus about \$235, while the principal balance is approximately \$5,340.78 (ignore the minus sign). Hence the actual total to be refinanced is **BAL** + 3 months penalty = \$5,340.78 + 3×\$235 = \$6,045.78. You can do this calculation at **COMP** mode, and use the answer memory in finding the new **PMT** later.

To find the new **PMT**, you return to **CMPD** and let **n** = 48 - 20 = 28, **I%** = 13.5, and **PV** = 6,045.78. All other values remain the same.

- Return to **CMPD** mode, key in all the new values, and then solve for [**PMT**].

  [CMPD] [▼] [2] [8] [EXE] [1] [3] [•] [5] [EXE]
  [(−)] [6] [0] [4] [5] [•] [7] [8] [EXE] [SOLVE]

```
n   =28
I%  =13.5
PV  =-6,045.78
PMT =252.9130458
```

The monthly installment after refinancing is \$252.9, which exceeds the original payment of \$235. Clearly the refinancing exercise is not a profitable decision and based on this financial comparison Livia should not refinance. **QED■**

Exercises

The purpose of the exercises is to enhance your mastery of the calculator.

1. Find the monthly installment of a 3-year, \$215,000 mortgage loan at interest of 10.3% compounded daily.

2. A company estimates that a machine will need to be replaced 10 years from now at a cost of \$350,000. How much must be set aside each year to provide that money if the company's savings earn interest at $j_2 = 8\%$?

3. Referring to the refinance issue in Example 2.12, Livia tells her banker that she will borrow the money from him if the monthly installment is \$230. What interest rate must he offer to fulfill that request?

4. A mortgage loan of \$170,000 is to be amortized with equal monthly payment over 10 years at $j_{12} = 6\%$. Find the total principal paid for the first 5 years.

5. Monthly payments of a certain business loan varies according to interest rate which in turn varies according to market forces. The duration required to repay however does not change. Suppose a company takes out a 10-year, \$500,000 loan at $j_{12} = 5.2\%$. After exactly 3.5 years interest rate changes to $j_{12} = 6.5\%$. Find the new monthly payment of the loan as a result of this change.

3 Analysing With CASH and CNVR

Equivalent Rates With CNVR

Interest rates are normally given as a rate per annum, and is commonly referred to as nominal rate of interest. In this chapter we say that the nominal rate of interest j_m (compounded m times a year) is equivalent to the annual effective interest rate j (compounded annually) if they both yield the same interest per year.

At the FC-100V/200V, you can convert the nominal rate to its equivalent effective rate, and conversely. Nominal rate is denoted as **APR** (annual percentage rate), while the effective interest rate is denoted as **EFF** in **CNVR** mode.

EXAMPLE 3.1 Find the rate j_{12} equivalent to j =10.08%.

SOLUTION:
It is clear that the number of compounding is **n** = 12, and **I%** is 10.08.

- Access **CNVR** mode, and enter the known values.

  CNVR

  1 2 EXE 1 0 • 0 8 EXE

```
                 D
Conversion
n   =12
I%  =10.08
▶EFF:Solve
```

- Scroll to choose [▶**APR**] and then solve it.

  ▼ SOLVE

```
                 D
APR =9.642251301
```

The nominal equivalent is therefore approximately $j_{12} = 9.64\%$. **QED■**

EXAMPLE 3.2 Find the rate j_2 equivalent to $j_4 = 12\%$.

SOLUTION:
As a direct conversion is not available, you can do as follow. First, you find the effective rate j which is equivalent to the nominal rate $j_4 = 12\%$, and then find j_2 that is equivalent to this effective rate.

- Access **CNVR** mode, and let **n** = 4, **I%** = 12.

  CNVR

  4 EXE 1 2 EXE

```
Conversion
n   =4
I%  =12
▶EFF:Solve
```

- With [▶**EFF**] selected, solve it.

  SOLVE

```
EFF =12.550881
```

So the effective rate equivalent to j_4 = 12% is ≈ 12.55%. Now you can find the equivalent nominal rate j_2 of this effective rate.

- Return to **CNVR** mode and let **n** = 2, but keep the value of **I%**. Scroll to solve [▶**APR**].

  CNVR 2 EXE

```
n   =2
I%  =12.550881
▶EFF:Solve
▶APR:Solve
```

  ▼ ▼ SOLVE

```
APR =12.18
```

So you have j_2=12.18% being equivalent to j_4 = 12%. This means that interests yield by these two nominal rates over a year, on the same amount of money, are the same. **QED■**

It is easy to get confused between **APR** and **EFF**; just remember that solving for **APR** will yield a lower interest rate, while solving for **EFF** will yield a higher rate. Also note that **APR** and **EFF** are essentially inverse functions of each other.

The FC-100V/FC-200V cannot perform rate conversion when the rate involved is a continuously compounded rate; this could however be overcame by assigning a large value to **n**, say 10^5.

EXAMPLE 3.3 Find the rate j_4 equivalent to $j_\infty = 9\%$.

SOLUTION:
The solution process to this example is similar to the one before, that is: first you find the effective rate j which is equivalent to $j_\infty = 9\%$, and then use this effective rate to find j_4.

- Access **CNVR** mode, let **n** = 100,000 and **I%** = 9.

  [CNVR] [1] [0] [0] [0] [0] [0] [EXE]
  [9] [EXE]

```
Conversion       D
n   =100,000
I%  =9
▶EFF:Solve
```

- With [▶**EFF**] selected, solve it.

  [SOLVE]

```
                 D
EFF =9.417423939
```

- Return to **CNVR** mode, key in 4 for [**n**] and scroll to solve [▶**APR**].

  [CNVR] [4] [EXE]
  [▼] [▼] [SOLVE]

```
                 D
APR =9.102009524
```

Hence, $j_\infty = 9\%$ is equivalent to $j_4 = 9.102\%$. An item to take note of is that the larger the value of **n** is assigned with, the higher the output's accuracy. In practice however, this high precision is usually not necessary. **QED■**

A common use of effective rate of interest is for comparing two or more financial situations. We end this section on **CNVR** mode with an example on using **CNVR** mode in making a financial decision.

EXAMPLE 3.4 A financial institution offers three types of guaranteed investment certificates paying interest rate at $j_{12} = 11\frac{1}{4}\%$, $j_4 = 11\frac{3}{4}\%$ and $j_1 = 12\frac{1}{4}\%$. Which options is the best?

SOLUTION:
To solve this problem, you just need to find the equivalent effective rates for all three nominal rates and compare them; the one with the largest effective rate is the best deal.

You can find the effective rate equivalent of $j_{12} = 11\frac{1}{4}\%$ as follow.

- Access **CNVR** mode, let **n** = 12 and **I%** = 11.25. Then solve [▶**EFF**].

  CNVR 1 2 EXE

  1 1 • 2 5 EXE

  SOLVE

```
Conversion
n   =12
I%  =11.25
▶EFF:Solve
```

```
EFF =11.84859374
```

The effective rate of $j_{12} = 11\frac{1}{4}\%$ is equivalent to $j = 11.85\%$.

- Return to **CNVR** mode, key in 4 for [**n**] and 11.75 for [**I%**], and then solve [▶**EFF**].

  CNVR 4 EXE 1 1 • 7 5 EXE SOLVE

```
EFF =12.2779478
```

Hence, the effective rate of $j_4 = 11\frac{3}{4}\%$ is equivalent to $j = 12.278\%$. Lastly, the effective rate of $j_1 = 12\frac{1}{4}\%$ is indeed $12\frac{1}{4}\%$, or 12.25%.

By comparison, the guaranteed investment certificates at $j_4 = 11\frac{3}{4}\%$ has the best rate of return, and therefore is the best financial option. **QED**■

Cash Flows with CASH

Evaluating future cash flows is one of the methods that help businesses make investment appraisals. The **CASH** mode can assist us in making the essential cash flows calculations. A neat feature is the list-like editor which allows user to scroll through and view all entries, which should help reduce data entering mistakes.

Similar to previous section, the discounting rate of interest is denoted as j_m. Sometimes this discounting rate is also known as cost of capital. The first example appraises a business proposal with two different discounting rates through the comparison of their net present values, **NPV**.

EXAMPLE 3.5 A project is expected to provide the cash flows indicated in Table 3.1. Is it financially feasible to invest $100,000 in this project if the cost of capital is (a) $j_1 = 7\%$, (b) $j_1 = 14\%$?

Year End	1	2	3	4
Cash Flow	$40,000	$25,000	$35,000	$30,000

Table 3.1

SOLUTION:
It is a good practice is to clear the data editor each time you begin a new cash flow calculation.

- Turn on the calculator and clear the data editor.

  [SHIFT] [9] [▼] [▼] [▼] [▼] [▼] [▼]
  [EXE] [EXE]

```
Complete!
Press [AC] key
```

Return to normal display by pressing [AC] once.

You should also check that the [**STAT**] at **SETUP** is turned off since this frees up 40 more spaces for cash flows entries. You can look up pages E-53 and E-110 of the User's Guide for more details.

- Access **SETUP**, and scroll to select [**STAT**] and turn it off if necessary.

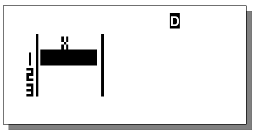
  [SETUP] [▼] [▼] ▪ ▪ ▪ [▼] [▼] [▼] [EXE] [2]
  [ESC]

```
Fix:Off
Sci:Off
Norm:1
STAT:Off
```

The first task is to key in the annual cash flows into the data editor. The first entry is the initial investment of -$100,000 follow by the expected annual earnings at end of each financial year.

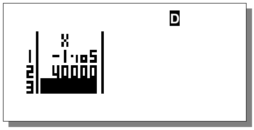
- Access **CASH** mode, and then scroll down to access [**D.Editor x**]

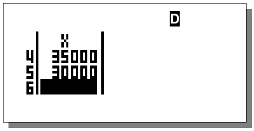
  [CASH] [▼] [EXE]



- Enter all the cash flows into *x*-column.

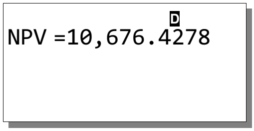
  [(−)] [1] [0] [0] [0] [0] [0] [EXE]
  [4] [0] [0] [0] [0] [EXE]
  [2] [5] [0] [0] [0] [EXE]
  [3] [5] [0] [0] [0] [EXE]
  [3] [0] [0] [0] [0] [EXE]





- Return to **CASH** mode, let **I%** = 7, and then solve [**NPV**] to appraise using the first cost of capital.

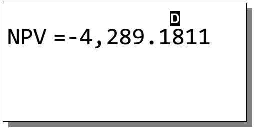
  [ESC] [7] [EXE] [▼] [SOLVE]



The net present value is approximately $10,676 when the cost of capital is 7%.

- Return to **CASH** mode, let **I%** = 14, and then solve [**NPV**] again.

  [CASH] [1] [4] [EXE] [▼] [SOLVE]



When the cost of capital is 14% you can expect a loss of about $4,289. Obviously the project is viable when cost of capital is 7% but not when it is 14%. **QED■**

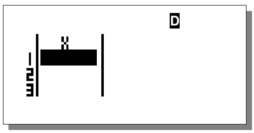
Apart from calculating **NPV**, another widely accepted cash flow analysis method is through the calculation of **IRR**, or internal rate of return.

EXAMPLE 3.6 An investment of $5 million is expected to return $1.75 million at the end of year 1 and year 2, and $2.5 million at the end of year 3. Calculate the **IRR** this investment is expected to produce.

SOLUTION:

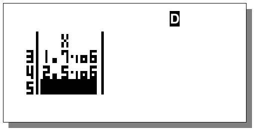
- Access **CASH** mode and enter data editor.

  [CASH] [▼] [EXE]



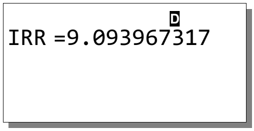
- Enter all the cash flows into *x*-column.

  (−) 5 0 0 0 0 0 0 EXE
  1 7 5 0 0 0 0 EXE
  1 7 5 0 0 0 0 EXE
  2 5 0 0 0 0 0 EXE



- Return to **CASH** mode and scroll to solve [**IRR**].

  CASH ▼ ▼ ▼ SOLVE



Hence the **IRR** for this investment is approximately 9.094%. **QED■**

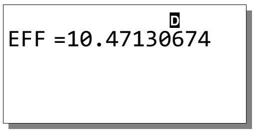
The FC-100V/200V also allows you to perform cash flow analysis with payback period (**PBP**) and net future value (**NFV**) of the investment. Plainly put **PBP** is the time (in unit of year) when **NPV** is equivalent to 0; while **NFV** is the accumulated value of **NPV** at the end of *n*-th period.

EXAMPLE 3.7 Find the corresponding payback period and net future value of the investment in Example 3.6 when cost of capital is $j_{12} = 10\%$.

SOLUTION:
First note that the cost of capital is a nominal rate, but the cash flow discounting setting of the calculator works way better with an effective rate. So, you should first convert j_{12} to its equivalent j_1.

- Access **CNVR** mode, enter all key values and solve for [►**EFF**].

  CNVR 1 2 EXE 1 0 EXE SOLVE



The equivalent effective rate is approximately $j_1 = 10.47\%$. You can use it to find **PBP** and **NFV**, assuming that the data editor has not been edited since Example 3.6. This effective rate of is automatically set as value for **I%** at **CASH** mode.

- Access **CASH** mode, and just scroll down to solve [**PBP**].

  CASH

  ▼ ▼ ▼ ▼

  SOLVE

```
Cash Flow                D
I%  =10.47130674
Csh=D.Editor x
NPV:Solve
```

```
Math ERROR               D

[AC]  :Cancel
```

The error message means there is no possible **PBP** at all! The simple explanation is that because the cost of capital $j_1 = 10.47\%$ is greater than the **IRR** (9.094%) obtained earlier, the implication is that this investment is going to produce a loss, and it will never be able to pay back the initial investment. This means that **NPV** is always < 0, and hence **PBP** cannot possibly has a real solution at all.

As a consequence, you should also expect **NFV** to be less than 0.

- Clear the error message to return to **CASH** mode, and scroll down to solve [**NFV**].

  AC ▼ SOLVE

```
                         D
NFV =-171,977.162
```

With **NFV** ≈ -171,977, this investment is certainly not viable. **QED■**

Exercises

The purpose of the exercises is to enhance your mastery of the calculator.

1. Find the effective rate equivalent to $j_{365} = 6.63\%$.

2. Show that $j_\infty = 7.4766\%$ is almost equivalent to $j_{12} = 7.5\%$.

3. Determine which trust fund offers the best return: SmallCap which pays interest rate at $j_{365} = 12.34\%$, or MainCap which pays $j_4 = 12.55\%$.

4. An entrepreneur plans to start a business, and in the proposal he projects that an initial investment of $9,000 is needed, and expect the business will make a loss of $3,500 after a year, earn $2,500 at the end of the second year, $5,000 at the end of the third year, and $6,000 at the end of the fourth year. After that he believes that he can sell off the business as a going concern at $10,000.

   Suppose the discount rate is 9.5%, find the internal rate of return of this proposal and determine the payback period.

4 Quantitative Methods

Calculating Probability

Counting selection choices and ways of arrangement are essential in finding the probability of any event. Let's discuss a couple of examples on such calculations. The default setting of the calculator is assumed for all these examples.

EXAMPLE 4.1 A plant produces 50 units of calculator each day, where 5 units are picked randomly to be inspected for possible defect. Find the probability that a unit is picked for inspection each day.

SOLUTION:

The main task is to find the number of ways you can pick 5 units out of 50 units. This means you should find the number of combinations of 5 objects from 50 objects, or $50C5 = \frac{50!}{5! \times 45!}$. The calculating operation is the same on both FC-200V and FC-100V.

- Enter **COMP** mode to find the combination with factorial function.

COMP 5 0 CTLG EXE ÷
(5 CTLG EXE × 4 5 CTLG EXE EXE

```
50!÷(5!×45!        D
            2118760
```

The number of ways is 2,118,760, and the probability is thus $\frac{1}{2118760}$.

Alternatively, you can use the built in combination function in the calculation. The operation is the same at both FC-200V and FC-100V.

- Find $50C5$ with the built-in combination function.

COMP 5 0 CTLG ▼ ▼ ▼ ▼ ▼
▼ ▼ ▼ ▼ EXE 5 EXE

```
50C5               D
            2118760
```

The result obtained should be the same. This function comes in handy if you cannot recall the formula for combination. **QED■**

EXAMPLE 4.2 How many words of three letters can be formed with the letters *A*, *B*, *C*, *D*, *E* and *F*?

SOLUTION:
The solution is about calculating the number of permutations of 3 objects from 5 objects, or $5P3 = \frac{5!}{2!}$.

- Access **COMP** mode and calculate using the built-in permutation function.

  COMP 5 CTLG

```
                D
Catalog
!
%
-1
```

- Scroll down to select [**P**], and calculate $5P3$.

  ▼ ▼ ▼ ▪ ▪ ▪ ▼ EXE 3 EXE

```
                D
5P3
                60
```

So 60 three-letter words can be formed with these five different letters. **QED■**

Single Variable Data Description

Descriptive statistics describe features of the data through summarized information and measurements. The **STAT** mode of FC-100V/200V can aid you in calculating the descriptive statistics efficiently.

It is practical to fix the number of decimal places to 2. Statistics with higher accuracy usually have no meaning in application. Also, in most of the situations, it is a good idea to reset the calculator before you begin any statistical calculation.

EXAMPLE 4.3 A survey of a month's grocery spending of 14 households at a certain town was conducted by a hypermarket operator. The data, corrected to the nearest dollar, is given below.

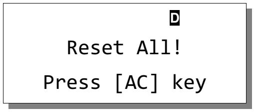
455	468	509	399	345	645
1047	634	527	1017	305	843
907	680				

Find the mean and standard deviation of the data.

SOLUTION:

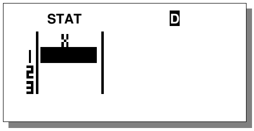
- Reset the calculator's settings and memory.

  SHIFT 9 ▼ ▼ EXE EXE



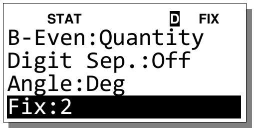
- Press AC to clear the screen. Then, access **STAT** mode single variable's data editor.

  STAT EXE



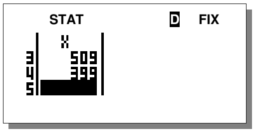
- Enter **SETUP** and scroll down to set [**FIX**] to 2.

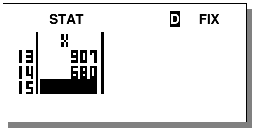
  SETUP ▼ ▼ ▪ ▪ ▪ ▼ EXE 2



- Return to **STAT** mode, and record all the data to the editor.

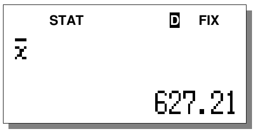
  ESC 4 5 5 EXE 4 6 8 EXE
  5 0 9 EXE 3 9 9 EXE
  3 4 5 EXE ▪ ▪ ▪
  ▪ ▪ ▪ 9 0 7 EXE 6 8 0 EXE



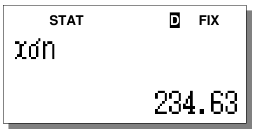


- Press AC to clear screen again. Access S-MENU to find data mean and standard deviation.

  SHIFT STAT 5 2 EXE



  SHIFT STAT 5 3 EXE



The mean spending is $627.21 and the standard deviation is $234.63. **QED**■

Correlation And Linear Regression

Correlation coefficient is an useful statistic in describing the linear relationship between two variables. The relationship is represented by the equation $y = Bx + A$. At the FC-100V/200V, you can find the correlation coefficient through [**A+BX**].

EXAMPLE 4.4 Market demand for a consumer product depends on its price. Record of its sales in relation to various prices is shown in Table 4.1. Calculate the correlation coefficient, ***r*** and describe what it means.

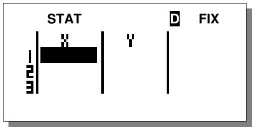
Price per unit ($), *X*	152	144	138	131	123	116
Sales in '000 units, *Y*	33	36	40	48	53	62

Table 4.1

SOLUTION:
Similar to Example 4.3, reset calculator if necessary, and fix decimal places to 2.

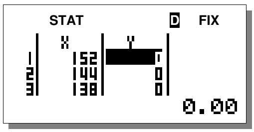
- Access **STAT** mode linear regression editor.

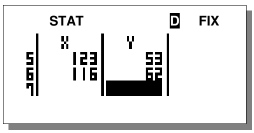
  [STAT] [▼] [EXE]



- Record price data into *x*-column, and sales data into *y*-column.

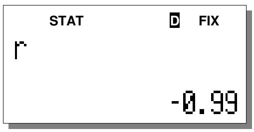
  [1] [5] [2] [EXE] [1] [4] [4] [EXE]
  [1] [3] [8] [EXE] [1] [3] [1] [EXE]
  [1] [2] [3] [EXE] [1] [1] [6] [EXE]
  [▶] [▼] [3] [3] [EXE] [3] [6] [EXE] [4] [0] [EXE]
  [4] [8] [EXE] [5] [3] [EXE] [6] [2] [EXE]





- Press [AC] to clear screen, then access S-MENU to find the correlation coefficient, ***r***.

  [SHIFT] [STAT] [7] [3] [EXE]



The value ***r*** = -0.99 implies there exists a strong negative relationship between price and sales. When price increases, the sales decreases, and vice versa. **QED■**

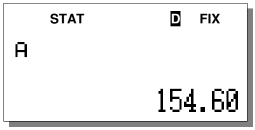
The regression line is useful in modeling the relationship between two variables, enabling forecasting of one variable when given the value of the other. The line is in the form of $y = Bx + A$, and at FC-100V/200V, both constants *A* and *B* can be found. In addition, estimation of either variable can be computed easily.

EXAMPLE 4.5 Refer to Example 4.4. (a) Find the regression line of sales, *Y*, on price per unit, *X*. (b) Estimate the sales when price per unit *X* is 160.

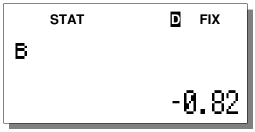
SOLUTION:
Suppose you are continuing from the last calculation in Example 4.4.

- Return to S-MENU to find the values of both constants.

  SHIFT STAT 7 1 EXE



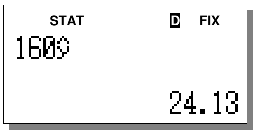
  SHIFT STAT 7 2 EXE



The linear regression is thus *Y* = 154.6 - 0.82*X*.

- Again return to S-MENU to estimate sales when selling price is 160.

  1 6 0 SHIFT STAT 7 5 EXE



The forecast for sales when price per unit, *X* = $160, is 24,130 units. **QED■**

Exercises

The purpose of the exercises is to enhance your mastery of the calculator.

1. In how many ways can these 6 letters *A*, *B*, *C*, *D*, *E* and *F* be arranged?

2. Below are responses from a survey on the number of hours spent watching television per week. Find the sample variance and mean hours spent at **STAT** mode.

Hours Spent	Frequency
5	4
8	9
11	14
14	15
17	21
20	24
22	14
25	8

3. Record of some paired data is given below.

X	3	5	9	3	15	11	8	6
Y	11	4	5	17	4	9	15	9

(a) Calculate the covariance.
(b) Calculate the variance of Y.
(c) Estimate value of X when Y is 2.5.

5 Calculating With BOND and DEPR

BOND Calculations

A bond is an agreement to pay in future a certain amount of money, while paying another sum of money periodically based on a fixed rate of interest. As such, it is very similar in nature to an annuity, and therefore most bond analysis can be made at the **CMPD** mode. For the benefits of FC-100V owners, we include solutions with **CMPD** for the first two examples in this chapter.

You can perform bond analysis much more efficiently in **BOND** mode, which is only available in FC-200V. The initial date set up in **BOND** mode is 365 while the redemption price, or **RDV**, is normally set as $100 of face value. The nominal rate of interest is denoted as j_m (compounded *m* times a year).

Before any bond calculation is performed, the setting of the date/period in **BOND** mode must correspond with the conditions of the calculations. Shown at Table 5.1 are the four possible settings and when they should be selected.

Shown at Screen	Set to This When
Set:Annu/Term	Yield is compounded annually
Set:Semi/Term	Yield is compounded semiannually.
Set:Annu/Date	Yield is compounded annually and the purchase and redeem dates are provided.
Set:Semi/Date	Yield is compounded semiannually, and the purchase and redeem dates are provided.

Table 5.1

EXAMPLE 5.1 A $1,000 bond that pays interest at $j_2 = 12\%$ is redeemable at par at the end of 10 years. Find the purchase price to yield 10% compounded semiannually.

SOLUTION:
We shall first look at how to solve this financial situation at **CMPD** mode, and then solve it again in **BOND** mode.

[Solving With CMPD Mode]

As the bond pays interest semiannually at 12%, this means that **P/Y** = 2 and **PMT** = (1,000×12%)/2 = 60. Your task is to find the purchase price **PV** that would yield j_2 = 10% upon the bond maturation date. Hence this is a compound calculation with **n** = 2×10, **I%** = 10, **C/Y** = 2, and **FV** = 1,000.

- Access **CMPD** mode and key in all known values.

  CMPD

  ▼ 2 0 EXE 1 0 EXE

  ▼ 6 0 EXE 1 0 0 0 EXE

  2 EXE 2 EXE

```
                D
n   =20
I%  =10
PV  =0
PMT =60
```

```
                D
PMT =60
FV  =1,000
P/Y =2
C/Y =2
```

- Scroll up to select [**PV**] and solve it.

  ▲ ▲ ▲ ▲ SOLVE

```
                D
PV  =-1,124.6221
PMT =60
FV  =1,000
P/Y =2
```

Th bond would return j_2 = 10% on the investment if you pay $1,124.62 for it. You will get a better rate of return if you pay less of course.

[Solving With BOND Mode On FC-200V]

The similar situation can be tackled at **BOND** mode. In **BOND** mode, **RDV** is the redemption price, **CPN** is nominal interest or annual coupon rate, **PRC** is purchase price and **YLD** is the annual yield. You should see page E-76 of User's Guide for more information.

It is obvious that the date/period setting should be [**Set:Semi/Term**]. Also, you have **n** = 20, **RDV** is 100 unless stated otherwise, **CPN** = 12, and **YLD** = 10. The goal is to find the purchase price **PRC**.

- Access **BOND** mode, and then set date/period to [**Semi/Term**].

  BOND EXE EXE 2 EXE ▼ EXE 2

```
                D
Bond Calc.
Set:Semi/Term
n   =0
RDV =0
```

- Scroll to enter all known values.

  ▼ 2 0 EXE 1 0 0 EXE
  1 2 EXE ▼ 1 0 EXE

```
RDV =100
CPN =12
PRC =0
YLD =10
```

- Scroll up to solve [**PRC**].

  ▲ SOLVE

```
PRC =-112.4622103
INT =0
CST =-112.4622103
```

The purchase price **PRC** ≈ \$112.462 is based on the face value of \$100. Therefore, for the \$1,000 bond the purchase price is \$112.462×10 = \$1,124.62. **QED**■

You also obtain **INT** and **CST** from the calculation. **INT** is the interest accrued over the time between when the bond is purchased, and when the last coupon payment was made. **CST** is defined as **PRC** + **INT**. **INT** is 0 in this example because we assumed that the purchase date coincides with the compound period.

The redemption price, **RDV**, is usually set to \$100. However, sometimes it is given as a condition and you should use the given value as **RDV**.

EXAMPLE 5.2 A \$5,000 bond that matures at 103 on October 1, 2009, has semiannual coupons at 10.5%. Find the purchase price on April 1, 2002, to yield 9.5% compounded semiannually.

SOLUTION:

[Solving With CMPD Mode]

You should be able to notice that the difference in year between the two dates is 7.5 years, so **n** = 2×7.5 = 15. Also, it is clear that **P/Y** = **C/Y** = 2, **I%** = 9.5, **PMT** = (5,000×10.5%)/2 = 262.5, and **FV** = (5,000/100)×103 = 5,150. Your task is to find **PV**, which is the purchase price you are looking for.

- Access **CMPD** mode and key in all known values.

  CMPD ▼ 1 5 EXE 9 • 5 EXE
  ▼ 2 6 2 • 5 EXE
  5 1 5 0 EXE 2 EXE 2 EXE

```
PMT =262.5
FV  =5,150
P/Y =2
C/Y =2
```

- Scroll up to select [**PV**] and solve it.

  ▲ ▲ ▲ ▲ SOLVE

```
PV  =-5,338.71184
PMT =262.5
FV  =5,150
P/Y =2
```

So the desired purchase price is about $5,338.71.

[Solving With BOND Mode On FC-200V]

You should easily identify all parameters for **BOND** mode. Here **RDV** = 103, **CPN** = 10.5, **YLD** = 9.5 and the date/period setting should be showing [**Set:Semi/Date**]. The purchase date is recorded as **d1**, and the maturation date is recorded as **d2**. The goal is to solve **PRC**.

- Access **BOND** mode, and then set date/period to [**Semi/Date**].

  BOND EXE EXE 2 EXE ▼ EXE 1

```
Bond Calc.
Set:Semi/Date
d1  =01012004
d2  =01012004
```

- Scroll down to enter the two dates.

  ▼ 0 4 0 1 2 0 0 2 EXE
  1 0 0 1 2 0 0 9 EXE

```
Set:Semi/Date
d1  =04012002
d2  =10012009
RDV =0
```

- Enter the rest of the known parameters, and then scroll up to solve [**PRC**].

  1 0 3 EXE 1 0 • 5 EXE
  ▼ 9 • 5 EXE ▲ SOLVE

```
PRC =-106.7742369
INT =0
CST =-106.7742369
```

So **PRC** is ≈ $106.7742 when based on the face value of $100. For the $5,000 bond the desired purchase price is $106.7742×(5,000/100) = $5,338.71. **QED■**

Callable bonds allow the issuer to redeem the bond prior to the maturity date and this presents calculation complication since the bond term is not certain. The next example shows it is relatively easy to solve such calculation on the FC-200V.

EXAMPLE 5.3 QED-Corp issues a 20-year, $1,000 bond with coupons at j_2 = 12%. The bond can be called at par after 15 years. Find the purchase price to yield 13% compounded semiannually.

SOLUTION:
The situation requires you to compare the **PRC** values found using both bond terms, i.e., for **n** = 2×15 = 30 and 2×20 = 40 respectively. Also, **RDV** = 100, **CPN** = 12, **YLD** = 13 and the date/period setting should be [**Set:Semi/Term**].

- Access **BOND** mode, and then set date/period to [**Semi/Term**].

  [BOND] [EXE] [EXE] [2] [EXE] [▼] [EXE] [2]

```
                 D
Bond Calc.
Set:Semi/Term
n   =0
RDV =0
```

- Solve for [**PRC**] when **n** = 30.

  [▼] [3] [0] [EXE] [1] [0] [0] [EXE]
  [1] [2] [EXE] [▼] [1] [3] [EXE] [▲] [SOLVE]

```
                 D
PRC =-93.47066205
INT =0
CST =-93.47066205
```

If the bond is called after 15 years the feasible purchase price of the bond should be $934.70 (93.47×10.)

- Now solve for [**PRC**] when **n** = 40.

  [ESC] [▲] [▲] [▲] [4] [0] [EXE]
  [▼] [▼] [SOLVE]

```
                 D
PRC =-92.92723657
INT =0
CST =-92.92723657
```

If the bond is allowed to reach maturity the purchase price should be $929.27 (92.927×10.) So, to ensure a return of 13% compounded semiannually, whether or not the bond is called earlier or not, you should choose the lowest of the two purchase prices, which in this case is $929.27. **QED■**

EXAMPLE 5.4 A $2,000 bond that is paying semiannual coupons at 9.5% and redeemable at par on July 20, 2009 is quoted at 96.5 on July 20, 1995. Find an approximate value of the yield rate to maturity, j_2.

SOLUTION:
The task is to find **YLD** with the given dates, **RDV** = 100, **CPN** = 9.5, and **PRC** = -96.5. The date/period setting should be [**Set:Semi/Date**].

- Access **BOND** mode, and then set date/period to [**Semi/Date**].

BOND EXE EXE 2 EXE ▼ EXE 1

```
Bond Calc.
Set :Semi/Date
d1  =01012004
d2  =01012004
```

- Enter the dates given for [**d1**] and [**d2**].

▼ 0 7 2 0 1 9 9 5 EXE
0 7 2 0 2 0 0 9 EXE

```
Set:Semi/Date
d1  =07201995
d2  =07202009
RDV =0
```

- Enter the known values and then solve [**YLD**].

1 0 0 EXE 9 • 5 EXE
(−) 9 6 • 5 EXE SOLVE

```
RDV =100
CPN =9.5
PRC =-96.5
YLD =9.969068265
```

The yield rate to maturity of this bond is approximately 9.97%. **QED**■

Depreciation Accounting With DEPR

Depreciation accounting is important in the financial management of a company. There are several methods of calculating depreciation and at **DEPR** mode you can choose to calculate depreciation using one of the four methods provided: Straight-Line, Fixed-Percentage, Sum-of-year's Digits and Declining Balance.

At **DEPR** mode, **n** denotes the estimated useful life of the asset, **PV** denotes the original cost of asset, **j** denotes the year for which the depreciation calculation is performed, **FV** is the estimated residual book value and **YR1** denotes the number of months in the first year of the depreciation. You can look up page E-67 of the User's Guide for more explanation.

EXAMPLE 5.5 A machine costing $300,000 has an estimated lifetime of 15 years and zero scrap value at that time. At the end of 6 years, the machine becomes obsolete because of the development of a better machine. What are the total accumulated depreciation and the book value of the asset at that time, under the Straight-Line method?

SOLUTION:
This calculation only needs you to record **n** = 15, **PV** = 300,000, **FV** = 0, **j** = 6 and **YR1** = 12 into the FC-200V. Other parameters are not relevant here.

- Access **DEPR** mode and enter all the key values.

  DEPR 1 5 EXE ▼ 3 0 0 0 0
  0 EXE 0 EXE 6 EXE 1 2 EXE

```
                D
FV  =0
j   =6
YR1 =12
SL  :Solve
```

- With [**SL**] selected, solve it.

  SOLVE

```
                D
SL  =20,000
RDV =180,000
j   =6
```

You have two outputs: **SL** is the depreciation expense for year **j** = 6 found using the Straight-Line method, while **RDV** is the remaining depreciable value at the end of 6th year. The accumulated depreciation is thus 6×20,000 = $120,000, and the book value of the asset at the end of 6th year is $180,000. **QED■**

EXAMPLE 5.6 Equipment costing $60,000 depreciates 10% of its value each year. Find the book value at the end of 6 years and the depreciation expense in year 7. The scrap value of the equipment is assumed as zero.

SOLUTION:
The problem statement clearly indicates that you should use the Fixed-Percentage method. For the calculation to be relevant, you should assign a value greater than 7 to **n**. Let's arbitrarily take **n** = 10. You also have **I%** = 10, **PV** = 60,000, **FV** = 0 and **YR1** = 12. For the first part of the solution just let **j** = 6.

- Access **DEPR** mode and enter all the known values, and then scroll down to solve [**FP**].

  DEPR 1 0 EXE 1 0 EXE
  6 0 0 0 0 EXE 0 EXE 6 EXE
  1 2 EXE

```
                D
FV  =0
j   =6
YR1 =12
SL  :Solve
```

  ▼ SOLVE

```
                D
FP  =3,542.94
RDV =31,886.46
j   =6
```

The book value of the equipment at the end of 6th year is thus $31,886.46 while the corresponding depreciation expense for that year is $3,542.94.

You should be mindful that the book value mentioned is in fact **RDV** + **FV** = $31,886.46 + 0. **RDV** is the remaining depreciable value at the end of 6th year, not the book value of the equipment. Next, to find the depreciation expense in year 7, you should return to **DEPR** mode and key in 7 for [**j**].

- Return to **DEPR** mode and enter 7 for [**j**].

  ESC ▲ ▲ ▲ 7 EXE

```
            D
j   =7
YR1 =12
SL  :Solve
FP  =Solve
```

- Scroll down to solve [**FP**] again.

  ▼ ▼ SOLVE

```
            D
FP  =3,188.646
RDV =28,697.814
j   =7
```

The depreciation expense for year 7 is $3,188.646. **QED■**

One of the accelerated depreciation methods built into **DEPR** mode is the Sum-of-year's Digits method.

EXAMPLE 5.7 Redo Example 5.5 to find the total accumulated depreciation and the book value of the asset under the Sum-of-year's Digits method.

SOLUTION:
Recall that **n** = 15, **PV** = 300,000, **FV** = 0, **j** = 6 and **YR1** = 12.

- Access **DEPR** mode, enter all the known key values, and then solve for [**SYD**].

  DEPR 1 5 EXE ▼ 3 0 0 0 0
  0 EXE 0 EXE 6 EXE 1 2 EXE

```
            D
FV  =0
j   =6
YR1 =12
SL  :Solve
```

  ▼ ▼ SOLVE

```
            D
SYD =25,000
RDV =112,500
j   =6
```

Under the Sum-of-year's Digit method, the book value of the machine is $112,500 and the total accumulated depreciation is $300,000 - $112,500 = $187,500. **QED■**

In many cases of depreciation accounting, constructing a depreciation schedule can greatly help the accounting process. Let's construct one such schedule in the next example, using the Declining Balance method. This is an accelerated depreciation method which uses a declining balance factor of between 100% to 200%.

EXAMPLE 5.8 A computer server that costs $40,000 is estimated to have a scrap value of $5,000 after 5 years. Construct its depreciation schedule using the Single Declining Balance method.

SOLUTION:
It is clear that **n** = 5, **PV** = 40,000, **FV** = 5,000, and **YR1** = 12. In addition, **I%** must be set to 100, which represents the factor of 1. You begin with **j** = 1, find the corresponding depreciate expense and book value, and repeat the process with **j** = 2, 3, 4, and 5. The table would then be constructed using these 5 sets of values.

- Access **DEPR** mode, enter all the known values, with **j** = 1, and solve [**DB**].

  DEPR 5 EXE 1 0 0 EXE 4 0 0 0 0 EXE 5 0 0 0 EXE

  1 EXE 1 2 EXE ▼ ▼ ▼
  SOLVE

```
                 D
I%  =100
PV  =40,000
FV  =5,000
j   =1
```

```
                 D
DB  =8,000
RDV =27,000
j   =1
```

The depreciation expense for year 1 is thus $8,000 and the book value at the end of the year 1 is **RDV** + **FV** = $27,000 + $5,000 = $32,000.

- Return to **DEPR** mode, and solve [**DB**] with **j** = 2.

  ESC ▲ ▲ ▲ ▲ ▲
  2 EXE

  ▼ ▼ ▼ ▼ SOLVE

```
                 D
j   =2
YR1 =12
SL  :Solve
FP  :Solve
```

```
                 D
DB  =6,400
RDV =20,600
j   =2
```

Repeat this process with **j** = 3, 4, and 5, and record the corresponding depreciation expenses and book values, and you can construct the following schedule.

End of Year	Depreciation Expense	Book Value
0	$0	$40,000
1	$8,000	$32,000
2	$6,400	$25,600
3	$5,120	$20,480
4	$4,096	$16,384
5	$11,384	$5,000

Table 5.2

The numbers in the 5th year are inconsistent with the rest in order to keep the book value same as scrap value. In most events you may switch to the Straight-Line method after year 3; this however is beyond our scope of discussion. **QED■**

Sometimes a higher factor is allowed in the Declining Balance method. You can choose a factor of 150% (factor 1.5) or 200% (factor 2) to accelerate the depreciation. When the factor is 200%, the method is commonly known as the Double Declining Balance method.

EXAMPLE 5.9 On March 1, 2004, QED-Corp purchased a stamping machines that costs $90,000. It is estimated to have a salvage value of $10,000 after 5 years. QED-Corp recognizes depreciation to the nearest whole month. Construct the depreciation table using Double Declining Balance method.

SOLUTION:
You are given that **n** = 5, **PV** = 90,000, **FV** = 10,000. The declining factor should be **I%** = 200, and **YR1** = 10, the number of months in depreciation year of 2004.

- Access **DEPR** mode, and solve [**DB**] with **j** = 1.

DEPR 5 EXE 2 0 0 EXE 9 0 0 0 0 EXE 1 0 0 0 0 EXE 1 EXE 1 0 EXE ▼ ▼ ▼

```
              D
I%  =200
PV  =90,000
FV  =10,000
j   =1
```

SOLVE

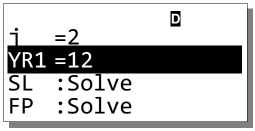
```
              D
DB  =30,000
RDV =50,000
j   =1
```

The depreciation expense for 2004 is \$30,000 and the book value at the end of 2004 is \$50,000 + \$10,000 = \$60,000.

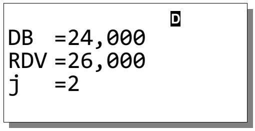
- Return to **DEPR** mode, and solve [**DB**] with **j** = 2.

  ESC ▲ ▲ ▲ ▲ ▲

  2 EXE



  ▼ ▼ ▼ ▼ SOLVE



Repeat this process with **j** = 3, 4, and 5, and you can construct the depreciation schedule in the end.

Year	Book Value at the beginning	Depreciation Expense	Book Value at year-end
2004	\$90,000	\$30,000	\$60,000
2005	\$60,000	\$24,000	\$36,000
2006	\$36,000	\$14,400	\$21,600
2007	\$21,600	\$8,640	\$12,960
2008	\$12,960	\$2,960	\$10,000

Table 5.3

Again, as with the case in the previous example, the year 5 depreciation expense is kept at \$2,960 by **DEPR** mode to keep book value same as salvage value. **QED■**

Exercises

The purpose of the exercises is to enhance your mastery of the calculator.

1. Redo Example 5.4 with the **CMPD** mode.

2. Redo Example 5.9 using declining balance factor of 1.5.

3. A $1,000 bond, issued on Dec 1, 2000, pays semiannual coupons at 10.5%, with a 360-day calendar. It is redeemable at par on Dec 1, 2015. Jun purchased the bond on July 20, 2006 when it is selling at 112.435. The bond is callable on Dec 1, 2010 at 105. Determine the yield to maturity and yield to call for Jun.

4. A company purchased a tractor for $180,000. It has an estimated useful life of 6 years and a residual value of $35,000. Find the depreciation expense and book value at the end of Year 3 under the Sum-of-year's Digits method.

Answers To Exercises

Chapter 1

1. Refer to page E-21 of the User's Guide.

```
Fix:Off
Sci:Off
Norm:1
STAT:On
```

2. The date is April 1, 2008.

```
Set:365
d1   =01152008
d2   =04012008
Dvs  =77
```

3. There are a few methods. Here we show two. The answer is 30% discount.

```
100(1-68.95÷98.5
                30
```

```
68.95-98.5Δ%
               -30
```

4. There are a few possible solutions. Here we show two. The answer is $91.026.

```
2(38.9+38.9×17%
            91.026
```

```
2×38.9×1.17
            91.026
```

5. The interest accrued is approximately $462.33.

```
SI   =462.3287671
SFV  =15,462.3288
```

6. One way is to calculate $5000\times(1 + 0.072)^3 - 5000$ at **COMP** mode.

```
5000(1+0.072)^(3
        6159.62624
```

```
Ans-5000
        1159.62624
```

Chapter 2

1. The task is to find **PMT** when **n** = 36, **PV** = 215,000, **I%** = 10.3.

```
PMT=6,972.106
FV =0
P/Y=12
C/Y=365
```

2. The task is to find **PMT** when **n** = 10, **FV** = 350,000, **PV** = 0, and **I%** = 8.

```
PMT=-23,977.3697
FV =350,000
P/Y=1
C/Y=2
```

3. The banker would have to offer a low rates, since **PMT** is fixed as $230.

```
Compound Int.
Set:End
n   =28
I% =13.5
```

```
I% =5.291596772
PV =-6,045.78
PMT:230
FV =0
```

4. Find **PMT** at **CMPD** mode, then use it to find principal total with **PM2** = 60.

```
n   =120
I% =6
PV =-170,000
PMT=1,887.34853
```

```
Amortization
Set:End
PM1=1
PM2=60
```

```
ΣPR=72,375.8388
```

5. Find the first **PMT** as $5,352.29, and find the principal balance after 3.5 years or 42 months. Use it as **PV** in calculation of new **PMT** = $5,570.35.

```
n   =120
I% =5.2
PV =-500,000
PMT=5,352.28961
```

```
BAL=-353,601.56
```

```
n   =78
I% =6.5
PV =-353,601.56
PMT=5,570.34685
```

Chapter 3

1. Go to **CNVR** and set **n** = 365 and **I%** = 6.63. The effective rate is 6.854%.

```
EFF=6.85407998
```

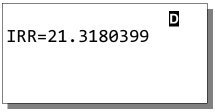
2. Find effective rates of both nominal rates and compare them.

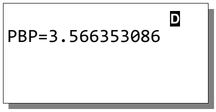
```
EFF=7.763195249
```

```
EFF=7.763259886
```

3. The MainCap trust fund which pays j_4 =12.55% is a better option.

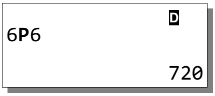
4. Last cash flow is 16,000. Scroll down to solve [**IRR**] and [**PBP**].

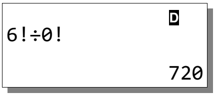


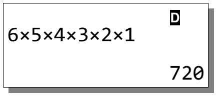


Chapter 4

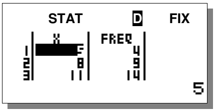
1. Number of arrangement is 720. Here we give 3 different solution methods.

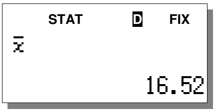


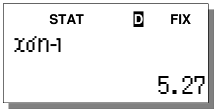




2. Go to **STAT** mode, select [**1-VAR**], and turn on [**STAT**] at **SETUP**. Mean is 16.52 and sample variance is 5.27.

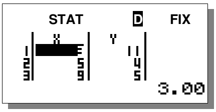


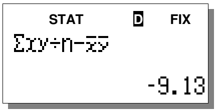




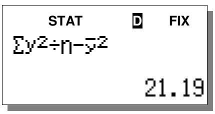
3. Go to **STAT** mode and choose [**A+BX**]. Key in the data accordingly.

   (a) Covariance is defined as $S_{xy} = \frac{\sum xy}{n} - \overline{x}\,\overline{y}$. The covariance is -9.13.

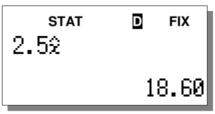




   (b) Variance of Y is defined as $S_y^2 = \frac{\sum y^2}{n} - \overline{y}^2$. The variance of Y is 21.19.



   (c) Estimate for X is 18.60 when Y is 2.5.



Chapter 5

1. The yield rate to maturity of this bond is 9.97%.

```
Set:End
n  =28
I% =0
PV =-1,930
```

```
PMT=95
FV =2,000
P/Y=2
C/Y=2
```

```
I% =9.969068265
PV =-1,930
PMT:95
FV =2,000
```

2.

Year	Book Value at the beginning	Depreciation Expense	Book Value at year-end
2004	$90,000	$22,500	$67,500
2005	$67,500	$20,250	$47,250
2006	$47,250	$14,175	$33,075
2007	$33,075	$9,922.5	$23,152.50
2008	$23,152.50	$6,945.75	$16,206.75

3. Yield to maturity date is 8.54%; yield to call date is 8.04%.

```
360
Set:Semi/Date
d1 =07202006
d2 =12012015
RDV=100
```

```
360
RDV=100
CPN=10.5
PRC=-112.435
YLD=8.540820206
```

```
360
RDV=105
CPN=10.5
PRC=-112.435
YLD=8.038714155
```

4. Depreciation expense is $27,619.05 and book value is $76,428.57.

```
PV =180,000
FV =35,000
j  =3
YR1=12
```

```
SYD=27,619.0476
RDV=41,428.5714
j  =3
```

Appendix: FC-200V/FC-100V Comparison Chart

Calculator Functions	FC-200V	FC-100V
Scientific Calculation	Yes	Yes
1- & 2- Variable Statistics	Yes	Yes
Statistical Regression	Yes	Yes
Simple Interest	Yes	Yes
Compound Interest	Yes	Yes
Cash Flow (IRR, NPV, PBP, NFV)	Yes	Yes
Amortization	Yes	Yes
Interest Rate Conversion	Yes	Yes
Cost & Margin Calculation	Yes	Yes
Days and Date Calculation	Yes	Yes
Depreciation	Yes	-
Bonds	Yes	-
Break Even Analysis	Yes	-
Key Areas of Applications		
Business and Finance Studies	●	●
Banking and Banking Studies	●	●
Insurance and Financial Planning	●	●
Investment Appraisal	●	●
Stock Market and Bonds	●	●
Business Financial Analysis	●	
Product Features		
Expression Entry Method	Algebraic	
Screen Display	4 Lines x 16 Characters	
Memory (plus Ans Memory)	8 Variables	
Programmable?	No	
Batteries	Solar Cell & LR44	1 x AAA-Size
Weight	105g	110g

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ISBN 978-983-44179-0-1

Price: RM30.00