Chapter 19

Financial Calculations

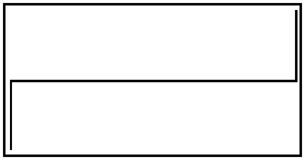
19-1 Before Performing Financial Calculations

The Financial Mode provides you with the tools to perform the following types of financial calculations.

- Simple interest
- Compound interest
- Investment appraisal (Cash Flow)
- Amortization
- Interest rate conversion (annual percentage rate and effective interest rate)
- Cost, selling price, margin
- Day/date calculations

•Graphing in the Financial Mode

After performing a financial calculation, you can use F6 (GRPH) to graph the results as shown below.



- Pressing SHIFT F1 (TRCE) while a graph is on the display activates Trace, which can be used to look up other financial values. In the case of simple interest, for example, pressing ▶ displays PV, SI, and SFV. Pressing ◀ displays the same values in reverse sequence.
- Zoom, Scroll, Sketch, and G-Solve cannot be used in the Financial Mode.

CFX

- In the Financial Mode, horizontal lines are blue and vertical lines are red. These colors are fixed and cannot be changed.
- The present value is positive when it represents receipt of money, and a negative value when it represents a payment.
- Note that calculation results produced in this mode should be regarded as reference values only.
- Whenever performing an actual financial transaction, be sure to check any calculation results obtained using this calculator with against the figures calculated by your financial institution.

•Set up screen settings

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Note the following points regarding set up screen settings whenever using the Financial Mode.

- The following graph set up screen settings are all turned off for graphing in the Financial Mode: Axes, Grid, Dual Screen.

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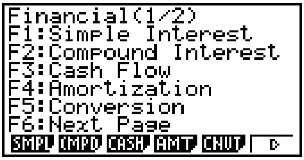
- Drawing a financial graph while the Label item is turned on, displays the label CASH for the vertical axis (deposits, withdrawals), and TIME for the horizontal axis (frequency).
- The number of display digits applied in the Financial Mode is different from the number of digits used in other modes. The calculators automatically reverts to Norm 1 whenever you enter the Financial Mode, which cancels a Sci (number of significant digits) or Eng (engineering notation) setting made in another mode.

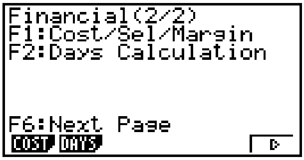
■ Entering the Financial Mode

On the Main Menu, select the **TVM** icon to enter the Financial Mode. When you do, the Financial 1 screen appears on the display.

Financial 1 screen



Financial 2 screen



- {**SMPL**}/{**CMPD**}/{**CASH**}/{**AMT**}/{**CNVT**}/{**COST**}/{**DAYS**} ... {simple interest}/{compound interest}/{cash flow}/{amortization}/{conversion}/{cost, selling price, margin}/{day/date} calculation

19-2 Simple Interest Calculations

This calculator uses the following formulas to calculate simple interest.

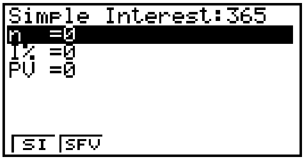
365-day Mode $SI' = \frac{n}{365} \times PV \times i \quad \left(i = \frac{I\%}{100}\right)$

360-day Mode $SI' = \frac{n}{360} \times PV \times i \quad \left(i = \frac{I\%}{100}\right)$

SI : interest
n : number of interest periods
PV : principal
$I\%$: annual interest
SFV : principal plus interest

$$SI = -SI'$$
$$SFV = -(PV + SI')$$

Press [F1] (SMPL) from the Financial 1 screen to display the following input screen for simple interest calculation.



n .... number of interest periods (days)

$I\%$ .... annual interest rate

PV .... principal

• {***SI***}/{***SFV***} ... calculates {interest}/{principal plus interest}

Example **What would the interest amount and principal plus interest be for a loan of $1,500 borrowed for 90 days at an annual rate of 7.25%?**

Use the 360-day mode and two decimal places.

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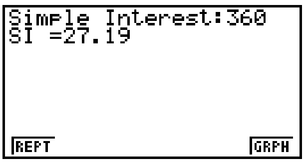
In the set up screen, specify "**360**" for Date Mode and "**Fix2**" for Display and then press [EXIT].

Perform the following key operations from the input screen.

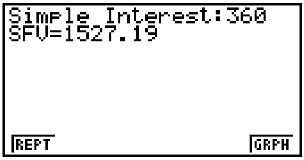
[9] [0] [EXE]
[7] [•] [2] [5] [EXE]
[(–)] [1] [5] [0] [0] [EXE]
[F1] (*SI*)



Now you can perform the following key operations to return to the input screen and then display the principal plus interest.

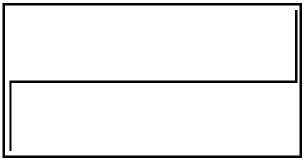
[F1](REPT) (Returns to the input screen)

[F2](*SFV*)



You can also press [F6] to draw a cash flow graph.

[F6](GRPH)



The left side is *PV*, while the right side is *SI* and *SFV*. The upper part of the graph is positive (+), while the bottom part is negative (–).

- V-Window values vary in accordance with simple interest conditions.

Press [EXIT] (or [SHIFT] [F6] (G↔T)) to return to the input screen.

Press [EXIT] again to return to the Financial 1 screen.

19-3 Compound Interest Calculations

This calculator uses the following standard formulas to calculate compound interest.

•Formula I

$$PV+PMT\times\frac{(1+i\times S)[(1+i)^n-1]}{i(1+i)^n}+FV\frac{1}{(1+i)^n}=0 \qquad \left(i=\frac{I\%}{100}\right)$$

Here:

$$PV=-(PMT\times\alpha+FV\times\beta)$$

$$FV=-\frac{PMT\times\alpha+PV}{\beta}$$

$$PMT=-\frac{PV+FV\times\beta}{\alpha}$$

$$n=\frac{\log\left\{\dfrac{(1+iS)\,PMT-FVi}{(1+iS)\,PMT+PVi}\right\}}{\log(1+i)}$$

$$\alpha=\frac{(1+i\times S)[(1+i)^n-1]}{i(1+i)^n}$$

$$\beta=\frac{1}{(1+i)^n}$$

PV : present value
FV : future value
PMT : payment
n : number of compound periods
$I\%$: annual interest rate

i is calculated using Newton's Method.

S = 1 assumed for beginning of term
S = 0 assumed for end of term

$F(i)$ = Formula I

$$F(i)'=\frac{PMT}{i}\left[-\frac{(1+iS)[1-(1+i)^{-n}]}{i}+(1+iS)[n(1+i)^{-n-1}]+S[1-(1+i)^{-n}]\right]$$

$$-nFV(1+i)^{-n-1}$$

•Formula II ($I\%$ = 0)

$$PV+PMT\times n+FV=0$$

Here:

$$PV=-(PMT\times n+FV)$$

$$FV=-(PMT\times n+PV)$$

$$PMT = -\frac{PV + FV}{n}$$

$$n = -\frac{PV + FV}{PMT}$$

- A deposit is indicated by a plus sign (+), while a withdrawal is indicated by a minus sign (–).

•Converting between the nominal interest rate and effective interest rate

The nominal interest rate (I% value input by user) is converted to an effective interest rate (I%') when the number of installments per year (P/Y) is different from the number of compound interest calculation periods (C/Y). This conversion is required for installment savings accounts, loan repayments, etc.

$$I\%' = \left\{ \left(1 + \frac{I\%}{100 \times [C/Y]}\right)^{\frac{[C/Y]}{[P/Y]}} - 1 \right\} \times 100$$

P/Y: installment periods per year
C/Y: compounding periods per year

When calculating n, PV, PMT, FV

The following calculation is performed after conversion from the nominal interest rate to the effective interest rate, and the result is used for all subsequent calculations.

$$i = I\%' \div 100$$

When calculating I%

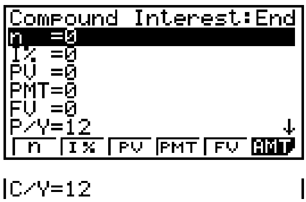
After I% is obtained, the following calculation is performed to convert to I%'.

$$I\%' = \left\{ \left(1 + \frac{I\%}{100}\right)^{\frac{[P/Y]}{[C/Y]}} - 1 \right\} \times [C/Y] \times 100$$

P/Y: installment periods per year
C/Y: compounding periods per year

The value of I%' is returned as the result of the I% calculation.

Press F2 (CMPD) in the Financial 1 screen to display the input screen for compound interest calculation.



n .... number of compound periods

I% .... annual interest rate

PV .... present value (loan amount in case of loan; principal in case of savings)

PMT .... payment for each installment (payment in case of loan; deposit in case of savings)

FV .... future value (unpaid balance in case of loan; principal plus interest in case of savings)

P/Y .... installment periods per year

C/Y .... compounding periods per year

Inputting Values

A period (n) is expressed as a positive value. Either the present value (PV) or future value (FV) is positive, while the other (PV or FV) is negative.

Precision

This calculator performs interest calculations using Newton's Method, which produces approximate values whose precision can be affected by various calculation conditions. Because of this, interest calculation results produced by this calculator should be used keeping the above limitation in mind or the results should be verified.

■ Compound Interest Examples

This section shows how compound interest calculations can be used in a variety of applications.

•Savings (standard compound interest)

Input Condition: Future value is greater than present value.

Formula Representation of Input Condition: $PMT = 0$

$|PV| < |FV|$

Example **Calculate the interest rate required to increase a principal of $10,000 to $12,000 in three years, when compounding is performed semiannually.**

Perform the following key operations from the input screen.

[3] [EXE] (Input n = 3.)

[▼]

[(-)] [1] [0] [0] [0] [0] [EXE] (PV = –10,000)

[0] [EXE]

[1] [2] [0] [0] [0] [EXE] (FV = 12,000)

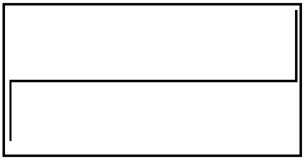
[1] [EXE]

[2] [EXE] (Semiannual compounding)

[F2] (I%)

Now you can press [F6] to draw a cash flow graph.

[F6](GRPH)



The left side is PV, while the right side is FV. The upper part of the graph is positive (+), while the bottom part is negative (–).

•Installment savings

Input Condition: Future value is greater than the total of payments.

Formula Representation of Input Condition:

PMT and FV have different signs (positive, negative) when $PV = 0$.

$-FV < n \times PMT$ when $FV > 0$

$-FV > n \times PMT$ when $FV < 0$

Example **Calculate the interest rate required to have a $2,500 balance in an installment savings account in two years when $100 is deposited each month and interest is compounded semiannually.**

Perform the following key operations from the input screen.

[2] [×] [1] [2] [EXE] (Input $n = 2 \times 12$.)

[▼]

[0] [EXE] ($PV = 0$)

[(–)] [1] [0] [0] [EXE] ($PMT = -100$)

[2] [5] [0] [0] [EXE] ($FV = 2{,}500$)

[1] [2] [EXE] (Monthly installment)

[2] [EXE] (Compounding every six months)

[F2] (I%)

•Loans

Input Condition: Total of payments is greater than loan amount.

Formula Representation of Input Condition:

PMT and PV have different signs (positive, negative) when $FV = 0$.

$-PV > n \times PMT$ when $PV > 0$

$-PV < n \times PMT$ when $PV < 0$

Example **Calculate the interest rate required to repay a $2,300 balance on a loan in two years paying back $100 per month, when interest is compounded monthly.**

Perform the following key operations from the input screen.

2 × 1 2 EXE (Input $n = 2 \times 12$.)

▼

2 3 0 0 EXE (PV = 2,300)

(–) 1 0 0 EXE (PMT = –100)

0 EXE (FV = 0)

1 2 EXE (Monthly installment)

(Monthly compounding)

F2 (I%)

The value you input for P/Y (the number of installment periods per year) is also automatically input for C/Y (the number of compounding periods per year). You can input another value for C/Y if you want.

•Loan when final installment is greater than other installments

Input Condition: Total of equal amount payments is greater than the difference between the loan amount and final payment amount.

Formula Representation of Input Condition:

PV, PMT, FV do not equal zero.

$PV + FV > -n \times PMT$ when $FV > PV$

$PV + FV < -n \times PMT$ when $FV < PV$

Example **Calculate the interest rate required to repay a $2,500 balance on a loan in two years (24 installments) paying back $100 per month and a final $200 installment, when interest is compounded monthly.**

Perform the following key operations from the input screen.

2 × 1 2 EXE (Input $n = 2 \times 12$.)

▼

2 5 0 0 EXE (PV = 2,500)

(–) 1 0 0 EXE (PMT = –100)

(–) 2 0 0 EXE (FV = –200)

1 2 EXE (Monthly installment)

(Monthly compounding)

F2 (I%)

■ Savings

•Future value

Example **Calculate the future value after 7.6 years for a principal of $500 and an interest rate of 6%, compounded annually.**

Perform the following key operations from the input screen.

[7] [•] [6] [EXE] (n = 7.6 years)
[6] [EXE] (I = 6%)
[(–)] [5] [0] [0] [EXE] (PV = –500)
[0] [EXE] (PMT = 0)
[0] [EXE] (FV = 0)
[1] [EXE]
[1] [EXE] (Annual compounding)
[F5] (FV)

•Principal

Example **Calculate the principal required at 5.5%, compounded monthly, to produce a total of $20,000 in a year.**

Perform the following key operations from the input screen.

[1] [EXE] (Input n = 1.)
[5] [•] [5] [EXE] (I = 5.5%)
[▼]
[0] [EXE] (PMT = 0)
[2] [0] [0] [0] [0] [EXE] (FV = 20,000)
[1] [EXE]
[1] [2] [EXE] (Monthly compounding)
[F3] (PV)

•Compound interest rate

Example **Calculate the interest required, compounded monthly, to produce a total of $10,000 in 10 years on an initial investment of $6,000.**

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In the set up screen, specify "**Begin**" for Payment and then press [EXIT].

Perform the following key operations from the input screen.

[1] [0] [EXE] (Input n = 10.)

[▼]

[(−)] [6] [0] [0] [0] [EXE] (PV = –6,000)

[0] [EXE] (PMT = 0)

[1] [0] [0] [0] [0] [EXE] (FV = 10,000)

[1] [EXE]

[1] [2] [EXE] (Monthly compounding)

[F2] (I%)

•Compound interest period

Example **Calculate the amount of time required to increase an initial investment of $5,000 to a total of $10,000 at an annual rate of 4%, compounded monthly.**

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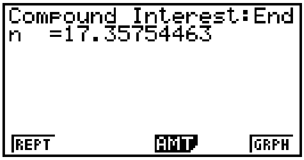
In the set up screen, specify "**End**" for Payment and then press [EXIT].

Perform the following key operations from the input screen.



[▼]

[4] [EXE] (I% = 4)

[(−)] [5] [0] [0] [0] [EXE] (PV = –5,000)

[0] [EXE] (PMT = 0)

[1] [0] [0] [0] [0] [EXE] (FV = 10,000)

[1] [EXE]

[1] [2] [EXE] (Monthly compounding)

[F1] (n)

•Installment savings

Example **Calculate (to two decimal places) the principal plus interest for $250 monthly installments for five years at 6% annual interest, compounded monthly.**

Calculate amounts for when installments are made at the beginning of each month and at the end of each month.

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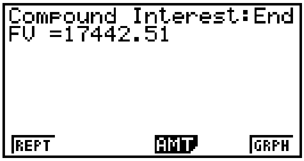
In the set up screen, specify "**End**" for Payment and "**Fix2**" for Display, and then press [EXIT].

Perform the following key operations from the input screen.



[5] [×] [1] [2] [EXE] (Input $n = 5 \times 12$.)
[6] [EXE] (I = 6.0%)
[0] [EXE] (PV = 0)
[(−)] [2] [5] [0] [EXE]
[▼]
[1] [2] [EXE] (Monthly installments)
(Monthly compounding)
[F5] (FV)

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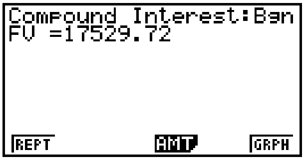
Specifying “**Begin**” for Payment in the set up screen changes to calculation of installments at the beginning of each month.

[F5] (FV)



•Installment amount

Example **Calculate the amount required for each installment to accumulate a total of $10,000 in 5 years at an annual interest rate of 6%, compounded semiannually.**

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In the set up screen, specify “**End**” for Payment, “**Norm1**” for Display, and then press [EXIT].

Perform the following key operations from the input screen.

[5] [×] [1] [2] [EXE] (Input $n = 5 \times 12$.)
[6] [EXE] (I = 6.0%)
[0] [EXE] (PV = 0)
[▼]
[1] [0] [0] [0] [0] [EXE] (FV = 10,000)
[1] [2] [EXE] (Monthly installments)
[2] [EXE] (Semiannual compounding)
[F4] (PMT)

•Number of installments

Example **Calculate the number of monthly $84 installments required to accumulate a total of $6,000 at an annual interest rate of 6%, compounded annually.**

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In the set up screen, specify "**End**" for Payment and then press [EXIT].

Perform the following key operations from the input screen.

▼
[6] [EXE]
[0] [EXE] ($PV = 0$)
[(-)] [8] [4] [EXE] ($PMT = -84$)
[6] [0] [0] [0] [EXE] ($FV = 6{,}000$)
[1] [2] [EXE] (Monthly installments)
[1] [EXE] (Annual compounding)
[F1] (n)

•Interest rate

Example **Calculate the annual interest rate required to accumulate a total of $10,000 in 10 years with $60 monthly installments.**

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In the set up screen, specify "**End**" for Payment and then press [EXIT].

Perform the following key operations from the input screen.

[1] [0] [×] [1] [2] [EXE] (Input $n = 10 \times 12$.)
▼
[0] [EXE] ($PV = 0$)
[(-)] [6] [0] [EXE] ($PMT = -60$)
[1] [0] [0] [0] [0] [EXE] ($FV = 10{,}000$)
[1] [2] [EXE] (Monthly installments)
[1] [EXE] (Annual compounding)
[F2] (I%)

•Principal plus interest with initial deposit

Example **Calculate the principal plus interest after one year for an installment savings account with an interest rate of 4.5%, compounded monthly, opened with an initial deposit of $1,000, with $500 installments added each month.**

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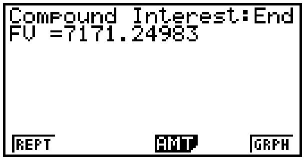
In the set up screen, specify "**End**" for Payment and then press [EXIT].

Perform the following key operations from the input screen.



1 × 1 2 EXE (Input n = 1 × 12.)
4 . 5 EXE
(−) 1 0 0 0 EXE (PV = –1,000)
(−) 5 0 0 EXE (PMT = –500)
▼
1 2 EXE (Monthly installments)
(Monthly compounding)
F5 (FV)

•Borrowing power

Example **Calculate how much can be borrowed on a 15-year loan at a 7.5% annual interest rate, compounded monthly, if a payment of \$450 per month can be made.**

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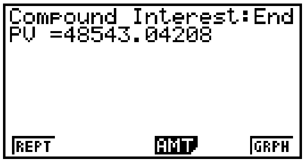
In the set up screen, specify "**End**" for Payment and then press EXIT.

Perform the following key operations from the input screen.



1 5 × 1 2 EXE (Input n = 15 × 12.)
7 . 5 EXE
▼
(−) 4 5 0 EXE (PMT = –450)
0 EXE (FV = 0)
1 2 EXE (Monthly installments)
(Monthly compounding)
F3 (PV)

•Loan installments

Example **Calculate the size of the monthly installment for a 25-year \$300,000 home loan made at 6.2%, compounded semiannually.**

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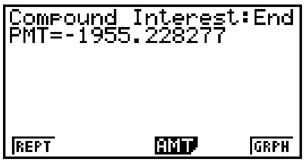
In the set up screen, specify "**End**" for Payment and then press EXIT.

Perform the following key operations from the input screen.



2 5 × 1 2 EXE (Input n = 25 × 12.)
6 . 2 EXE
3 0 0 0 0 0 EXE (PV = 300,000)
▼
0 EXE (FV = 0)
1 2 EXE (Monthly installments)
2 EXE (Semiannual compounding)
F4 (PMT)

•Number of installments

Example **Calculate the number of years it will take to repay a $60,000 loan borrowed at 5.5%, compounded monthly, with monthly installments of $840.**

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In the set up screen, specify "**End**" for Payment and then press [EXIT].

Perform the following key operations from the input screen.

[▼]
[5] [•] [5] [EXE]
[6] [0] [0] [0] [0] [EXE] (PV = 60,000)
[(–)] [8] [4] [0] [EXE] (PMT = –840)
[0] [EXE] (FV = 0)
[1] [2] [EXE] (Monthly installments)
(Monthly compounding)
[F1] (n)

•Effective interest rate

Example **Calculate (to two decimal places) the effective interest rate compounded monthly, on a 25-year $65,000 loan repaid with $460 monthly installments.**

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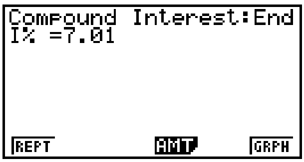
In the set up screen, specify "**End**" for Payment, "**Fix2**" for Display, and then press [EXIT].

Perform the following key operations from the input screen.

[2] [5] [×] [1] [2] [EXE] (Input n = 25 × 12.)
[▼]
[6] [5] [0] [0] [0] [EXE] (PV = 65,000)
[(–)] [4] [6] [0] [EXE] (PMT = –460)
[0] [EXE] (FV = 0)
[1] [2] [EXE] (Monthly installments)
(Monthly compounding)
[F2] (I%)

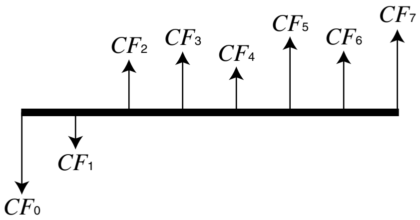


19-4 Investment Appraisal

This calculator uses the discounted cash flow (DCF) method to perform investment appraisal by totalling cash flow for a fixed period. This calculator can perform the following four types of investment appraisal.

- Net present value (*NPV*)
- Net future value (*NFV*)
- Internal rate of return (*IRR*)
- Pay back period (*PBP*)

A cash flow diagram like the one shown below helps to visualize the movement of funds.



With this graph, the initial investment amount is represented by CF_0. The cash flow one year later is shown by CF_1, two years later by CF_2, and so on.

Investment appraisal can be used to clearly determine whether an investment is realizing profits that were originally targeted.

•*NPV*

$$NPV = CF_0 + \frac{CF_1}{(1+i)} + \frac{CF_2}{(1+i)^2} + \frac{CF_3}{(1+i)^3} + \ldots + \frac{CF_n}{(1+i)^n}$$

n: natural number up to 254 $\left(i = \frac{I\%}{100}\right)$

•*NFV*

$$NFV = NPV \times (1+i)^n$$

•*IRR*

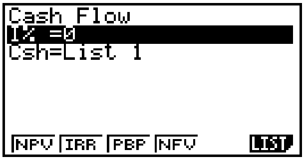
$$0 = CF_0 + \frac{CF_1}{(1+i)} + \frac{CF_2}{(1+i)^2} + \frac{CF_3}{(1+i)^3} + \ldots + \frac{CF_n}{(1+i)^n}$$

In this formula, $NPV = 0$, and the value of *IRR* is equivalent to $i \times 100$. It should be noted, however, that minute fractional values tend to accumulate during the subsequent calculations performed automatically by the calculator, so *NPV* never actually reaches exactly zero. *IRR* becomes more accurate the closer that *NPV* approaches to zero.

•*PBP*

PBP is the value of n when $NPV \geqq 0$ (when investment can be recovered).

Press [F3] (CASH) from the initial screen 1 to display the following input screen for investment appraisal.



I% .... interest rate

Csh .... list for cash flow

- •{**NPV**}/{**IRR**}/{**PBP**}/{**NFV**} ... {net present value}/{internal rate of return}/ {pay back period}/{net future value}
- •{**LIST**} ... {specifies a list for cash flow}

Example **An investment of $86,000 in machinery projects the annual revenues shown in the table below (all revenues realized at the end of the fiscal year). What is the net profit or loss of this investment if the useful service life of the machine is six years, the resale value after six years is $14,000, and the capital cost is 11%?**

Year	Revenues
1	–5,000
2	42,000
3	31,000
4	24,000
5	23,000
6	12,000 + 14,000

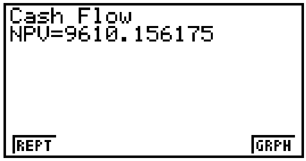
On the Main Menu, select the **LIST** icon to enter the LIST Mode and perform the following key operations.

[▶](List 2)
[(–)] [8] [6] [0] [0] [0] [EXE]
[(–)] [5] [0] [0] [0] [EXE]
[4] [2] [0] [0] [0] [EXE]
[3] [1] [0] [0] [0] [EXE]
[2] [4] [0] [0] [0] [EXE]
[2] [3] [0] [0] [0] [EXE]
[1] [2] [0] [0] [0] [+] [1] [4] [0] [0] [0] [EXE]

Return to the Main Menu by pressing [MENU]. Select the **TVM** icon to enter the Financial Mode, and then press [F3] (CASH).

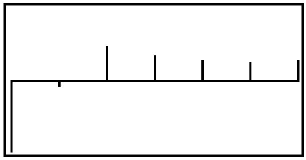
Perform the following key operations from the input screen.

1 1 EXE (I% = 11)
F6 (List) F2 (List2)
F1 (NPV)



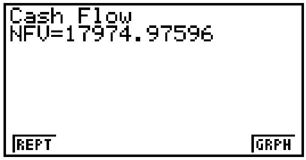
Now you can press F6 to draw a cash flow graph.

F6 (GRPH)

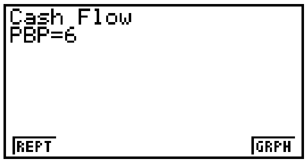


Pressing SHIFT F1 (TRCE) activates trace, which can be used to look up the following values.

SHIFT F6 (G↔T)
F4 (NFV)



F1 (REPT)
F3 (PBP)



Example **An investment of $10,000 in machinery projects the annual revenues shown in the table below (all revenues realized at the end of the fiscal year). What is the internal rate of return of this investment if the useful service life of the machinery is five years and the resale value after five years is $3,000?**

Year	Revenues
1	2,000
2	2,400
3	2,200
4	2,000
5	1,800 + 3,000

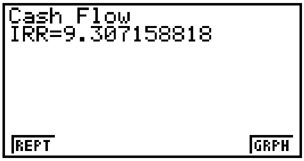
On the Main Menu, select the **LIST** icon to enter the LIST Mode and perform the following key operations.

▶ ▶ (List 3)
[(−)] [1] [0] [0] [0] [0] [EXE]
[2] [0] [0] [0] [EXE]
[2] [4] [0] [0] [EXE]
[2] [2] [0] [0] [EXE]
[2] [0] [0] [0] [EXE]
[1] [8] [0] [0] [+] [3] [0] [0] [0] [EXE]

Return to the Main Menu by pressing [MENU]. Select the **TVM** icon to enter the Financial Mode, and then press [F3] (CASH).

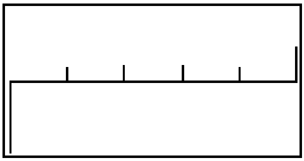
Perform the following key operations from the input screen.

▼
[F6] (List) [F3] (List 3)
[F2] (*IRR*)



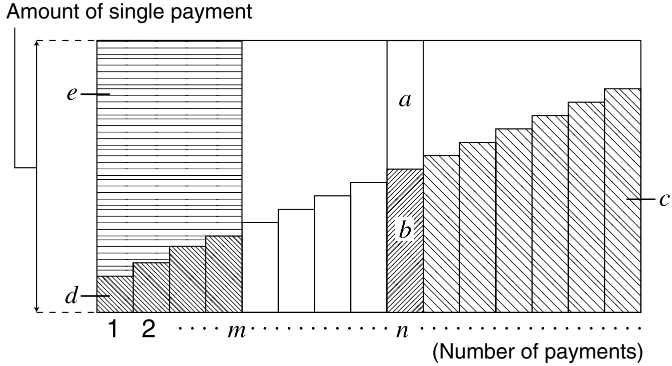
Now you can press [F6] to draw a cash flow graph.

[F6] (GRPH)



19-5 Amortization of a Loan

This calculator can be used to calculate the principal and interest portion of a monthly installment, the remaining principal, and amount of principal and interest repaid up to any point.



a: Interest portion of installment PM1 (INT)

b: Principal portion of installment PM1 (PRN)

c: Balance of principal after installment PM2 (BAL)

d: Total principal from installment PM1 to payment of installment PM2 (ΣPRN)

e: Total interest from installment PM1 to payment of installment PM2 (ΣINT)

* $a + b$ = one repayment (PMT)

$$a : INT_{\text{PM1}} = |\, BAL_{\text{PM1}-1} \times i \,| \times (PMT \text{ sign})$$

$$b : PRN_{\text{PM1}} = PMT + BAL_{\text{PM1}-1} \times i$$

$$c : BAL_{\text{PM2}} = BAL_{\text{PM2}-1} + PRN_{\text{PM2}}$$

$$d : \sum_{\text{PM1}}^{\text{PM2}} PRN = PRN_{\text{PM1}} + PRN_{\text{PM1}+1} + \ldots + PRN_{\text{PM2}}$$

$$e : \sum_{\text{PM1}}^{\text{PM2}} INT = INT_{\text{PM1}} + INT_{\text{PM1}+1} + \ldots + INT_{\text{PM2}}$$

$BAL_0 = PV$ ($INT_1 = 0$ and $PRN_1 = PMT$ at beginning of installment term)

•Converting between the nominal interest rate and effective interest rate

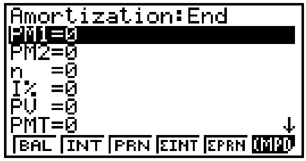
The nominal interest rate (I% value input by user) is converted to an effective interest rate (I%') for installment loans where the number of installments per year is different from the number of compound interest calculation periods.

$$I\%' = \left\{ \left(1 + \frac{I\%}{100 \times [C/Y]}\right)^{\frac{[C/Y]}{[P/Y]}} - 1 \right\} \times 100$$

The following calculation is performed after conversion from the nominal interest rate to the effective interest rate, and the result is used for all subsequent calculations.

$$i = I\%' \div 100$$

Press [F4] (*AMT*) from the initial screen 1 to display the following input screen for amortization.



PM1 .... first installment of installments 1 through *n*

PM2 .... second installment of installments 1 through *n*

n .... installments

I% .... interest rate

PV .... principal

PMT .... payment for each installment

FV .... balance following final installment

P/*Y* .... installments per year

C/*Y* .... compoundings per year

- {***BAL***} ... {balance of principal after installment PM2}
- {***INT***}/{***PRN***} ... {interest}/{principal} portion of installment PM1
- {Σ***INT***}/{Σ***PRN***} ... {total principal}/{total interest} from installment PM1 to payment of installment PM2

Example **Calculate the monthly installment due on a $140,000 15-year home mortgage at an annual rate of 6.5%, compounded semiannually.**

Also calculate *PRN* and *INT* for the second year (24th installment), *BAL* for installment 49, and Σ*INT*, Σ*PRN* for installments 24 through 49.

Display the TVM Menu and then press [F2] (CMPD).

P.7

In the set up screen, specify "**End**" for Payment and then press [EXIT].

Perform the following key operations from the input screen.

1 5 × 1 2 EXE (Input n = 15 × 12.)

6 • 5 EXE

1 4 0 0 0 0 EXE (PV = 140,000)

▼

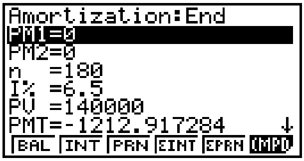
0 EXE (FV = 0)

1 2 EXE (Monthly installments)

2 EXE (Semiannual compounding)

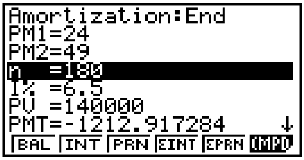
F4 (PMT)

Pressing F4 (AMT) displays the amortization input screen.



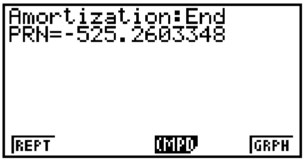
Input 24 for PM1 and 49 for PM2.

2 4 EXE 4 9 EXE



Calculate PRN.

F3 (PRN)



F1 (REPT)

F2 (INT)

F1 (REPT)

F1 (BAL)

Calculate Σ*INT* from installment 24 to 49.

F1 (REPT)

F4 (Σ*INT*)

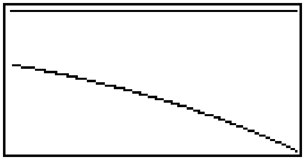
Calculate Σ*PRN*.

F1 (REPT)

F5 (Σ*PRN*)

Now you can press F6 to draw a cash flow graph.

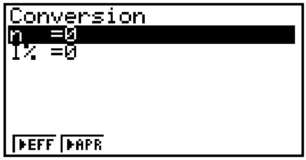
F6 (GRPH)



- Trace can be activated following the calculation. Pressing ▶ displays *INT* and *PRN* when n = 1. Each subsequent press of ▶ displays *INT* and *PRN* for n = 2, n = 3, and so on.

19-6 Conversion between Percentage Interest Rate and Effective Interest Rate

Press [F5] (CNVT) in the Financial 1 screen to display the following input screen for interest rate conversion.



n .... number of compoundings

I% .... interest rate

• {▶**EFF**}/{▶**APR**} ... {annual percentage rate to effective interest rate}/{effective interest rate to annual percentage rate} conversion

■ Converting the Annual Percentage Rate (*APR*) to the Effective Interest Rate (*EFF*)

$$EFF = \left[\left(1 + \frac{APR/100}{n}\right)^{n} - 1\right] \times 100$$

Example **Calculate (to two decimal places) the effective interest rate for an account paying an interest rate of 12%, compounded quarterly.**

P.6

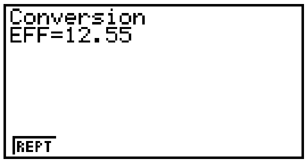
In the set up screen, specify "**Fix2**" for Display and then press [EXIT].

Perform the following key operations from the input screen.

[4] [EXE] (n = 4)

[1] [2] [EXE] (I% = 12%)

[F1] (▶EFF)



• The obtained value is assigned to I%.

■ Converting the Effective Interest Rate (*EFF*) to the Annual Percentage Rate (*APR*)

$$APR = \left[\left(1 + \frac{EFF}{100}\right)^{\frac{1}{n}} - 1\right] \times n \times 100$$

Example **Calculate the annual percentage rate for an account paying an effective interest rate of 12.55%, compounded quarterly.**

P.6

In the set up screen, specify “**Norm1**” for Display and then press EXIT.

Perform the following key operations from the input screen.

4 EXE (n = 4)

1 2 . 5 5 EXE (I% = 12.55%)

F2 (▶APR)

• The obtained value is assigned to I%.

19-7 Cost, Selling Price, Margin Calculations

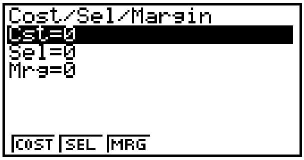
Cost, selling price, or margin can be calculated by inputting the other two values.

$$CST = SEL\left(1-\frac{MAR}{100}\right)$$

$$SEL = \frac{CST}{1-\dfrac{MAR}{100}}$$

$$MAR(\%) = \left(1-\frac{CST}{SEL}\right)\times 100$$

Press F1 (COST) from the initial screen 2 to display the following input screen.



Cst .... cost

Sel .... selling price

Mrg .... margin

- {**COST**}/{**SEL**}/{**MRG**} ... calculates {cost}/{selling price}/{margin}

■ Cost

Example **Calculate the cost for a selling price of \$2,000 and a margin of 15%.**

Perform the following key operations from the input screen.

▼

2 0 0 0 EXE (Sel = 2,000)

1 5 EXE (Mrg = 15)

F1 (COST)

■ Selling Price

Example **Calculate the selling price for a cost of $1,200 and a margin of 45%.**

Perform the following key operations from the input screen.

1 2 0 0 EXE (Cst = 1,200)

▼

4 5 EXE (Mrg = 45)

F2 (SEL)

■ Margin

Example **Calculate the margin for a selling price of $2,500 and a cost of $1,250.**

Perform the following key operations from the input screen.

1 2 5 0 EXE (Cst = 1,250)

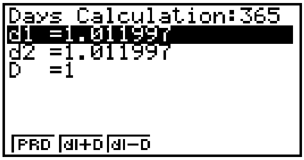
2 5 0 0 EXE (Sel = 2,500)

F3 (MRG)

19-8 Day/Date Calculations

You can calculate the number of days between two dates, or you can determine what date comes a specific number of days before or after another date.

Press [F2] (DAYS) from the initial screen 2 to display the following input screen for day/date calculation.



d1 .... date 1

d2 .... date 2

D .... number of days

- {**PRD**} ... {calculates number of dates between two dates (d2 – d1)}
- {**d1+D**}/{**d1–D**} ... Calculates {future date/previous date}

- The set up screen can be used to specify either a 365-day or 360-day year for financial calculations. Day/date calculations are also performed in accordance with the current setting for number of days in the year, but the following calculations cannot be performed when the 360-day year is set. Attempting to do so causes an error.

  (Date) + (Number of Days)

  (Date) – (Number of Days)
- The allowable calculation range is January 1, 1901 to December 31, 2099.

The format for inputting a date is: <month> [•] <day><year>

Two digits must always be input for the day, so a leading zero must be input for days 1 through 9.

Example **January 2, 1990**

[1] [•] [0] [2] [1] [9] [9] [0]

December 31, 2099

[1] [2] [•] [3] [1] [2] [0] [9] [9]

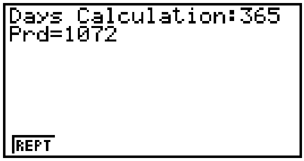
Example **Calculate the number of days from August 8, 1967 to July 15, 1970, using a 365-day year.**

P.7

In the set up screen, specify "**365**" for Date Mode and then press [EXIT].

Perform the following key operations from the input screen.

8 • 0 8 1 9 6 7 EXE
(d1 = August 8, 1967)
7 • 1 5 1 9 7 0 EXE
(d2 = July 15,1970)
F1 (PRD)



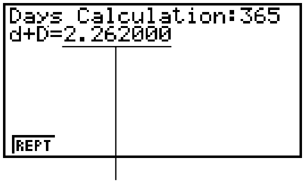
Prd .... number of days

Example **Determine the date that is 1,000 days after June 1, 1997.**

Note that the attempting to perform the following calculation while the 360-day year is in effect causes an error.

Perform the following key operations from the input screen.

6 • 0 1 1 9 9 7 EXE
(d1 = June 1, 1997)
▼ (d2 = Any date)
1 0 0 0 EXE
F2 (d1+D)



February 26, 2000

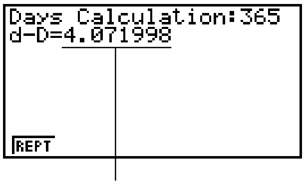
d+D .... future date calculation

Example **To determine the date that is 1,000 days before January 1, 2001, using a 365-day year.**

Note that the attempting to perform the following calculation while the 360-day year is in effect causes an error.

Perform the following key operations from the input screen.

1 • 0 1 2 0 0 1 EXE
(d1 = January 1, 2001)
▼ (d2 = Any date)
1 0 0 0 EXE
F3 (d1–D)



April 7, 1998

d–D .... previous date calculation