

# Contents for Business Calculator Help

You can use the Business Calculator to perform many advanced business, financial, and statistical calculations, as well as, basic calculations. It also provides multiple memory registers and a calculator tape that you can edit.

To learn how to use Help, press F1.

## KEYBOARD

[Financial Functions](#)

[Memory Functions](#)

[Standard Calculator Functions](#)

[Statistical Functions](#)

## COMMANDS

[Application Control Menu](#)

[File](#)

[Edit](#)

[View](#)

[Format](#)

### **Procedures:**

[Date Calculations](#)

[Time Value of Money](#)

[Option Pricing](#)

[Loan Amortization](#)

## HOW TO...

[Accumulated Interest and Principal Calculations](#)

[Calculating Effective Annual Rates and APR's](#)

[Cost, Selling Price, Margin, and Mark-up](#)

[Entering Uneven Cash Flows](#)

[Growing Annuities](#)

[Internal Rate of Return Analysis](#)

[Loan Amortization Calculations](#)

[Net Present Value Analysis](#)

[Time Value of Money Calculations](#)

[Working with Memory Registers](#)

[Advanced Calculator Functions](#)

[Performing Calculations](#)

[One Variable Statistical Analysis](#)

[Two Variable or Regression Analysis](#)

[Using Statistical Functions](#)

[Using Business Calculator with Clipboard](#)

## Business/Financial Functions

To use the business/financial functions in the Business Calculator, click the following buttons or press the keyboard equivalent.

<b>Button</b>	<b>Key</b>	<b>Function</b>
COMP	C	Compute - Use to compute CST, SEL, MAR, MU, n, i, PV, FV, PMT, APR, and EFF.
CFt	\$	Cash Flow for period t - This is used when calculating NPV and IRR. When you choose CFt, the value that is in the display is entered into the Cash Flow Box. If more than 1 consecutive period has the same cash flow, use Nt in conjunction with CFt.
Nt	#	Number of periods with the same cash flow - Use with CFt when there is more than 1 consecutive period with the same cash flow. The number in the display when you press Nt is the number of periods with the same cash flow. Then you may enter the cash flow and press CFt.
NPV	Y	Net Present Value - Calculates the net present value of the numbers in the cash flow box using the interest rate entered into i.
IRR	?	Internal Rate of Return - Calculates the internal rate of return of the numbers in the cash flow box.
n	n	Number of periods - The number in the display will be entered into the n register. If you want to compute n, enter the appropriate numbers in i, PV, FV, and PMT then press COMP n.
i	i	Interest Rate - The number in the display is entered into the i register. It should be entered as a PERCENT not a DECIMAL. If you wish to compute i, enter the appropriate numbers in n, PV, FV, and PMT then press COMP i. This calculation may take a little time.
PV	P	Present Value - The number in the display is entered into the PV register. If you wish to compute the present value, enter the appropriate values in n, i, FV, and PMT then press COMP PV.
FV	F	Future Value - The number in the display is entered into the FV register. If you wish to compute the future value, enter the appropriate values in n, i, PV, and PMT then press COMP FV.
PMT	H	Annuity Payment - The number in the display is entered into the PMT register. To use this function, the payments must be equal for all n periods. If the BGN key is not set, it is assumed that the payments come at the end of each period. To calculate the annuity payment, enter the appropriate values in n, i, PV, and FV then press COMP PMT.
g	G	Growth Rate - The number in the display is entered into the g register. This is the rate that payments are increasing for a growing annuity. It should be entered as a PERCENT, not a DECIMAL.
BGN	B	Beginning of the period - Pressing the BGN key tells the calculator that the payments occur at the beginning of the period instead of the end of the period. It is used with n, i, PV, FV, and PMT.

EFF	W	Effective Annual Rate - Converts the number entered into APR an effective annual rate using the number of compounding periods entered into n.
APR	A	Annual Percentage Rate - Converts the number entered into EFF into an annual percentage rate using the number of compounding periods entered into n.
AMRT	Z	Amortization - Numbers must be entered into n, i, PV, FV, and PMT. By pressing AMRT, an mortization table is displayed which can be edited, printed, saved, and copied to other applications.
P1	J	Period 1 of the Accumulation Periods - Numbers must be entered into n, i, PV, FV, and PMT. Enter the first period you are interested in and press P1.
P2	K	Period 2 of the Accumulation Periods - Numbers must be entered into n, i, PV, FV, and PMT. Enter the last period you are interested in and press P2.
SEL	S	Selling Price - The number in the display is entered into the SEL register. To calculate the selling price enter the appropriate numbers into CST, MAR, and MU then press COMP SEL. You only need either MAR or MU, not both.
MAR	M	Margin - The number in the display is entered into the MAR register. Enter as a PERCENT not a DECIMAL. To calculate the margin, enter the appropriate numbers into CST, SEL, and MU then press COMP MAR.
MU	U	Mark-up - The number in the display is entered into the MU register. Enter as a PERCENT not a DECIMAL. To calculate the mark-up enter the appropriate numbers into CST, SEL, and MAR then press COMP MU.
CST	T	Cost - The number in the display is entered into the CST register. To calculate the cost enter the appropriate numbers into SEL, MAR, and MU then press COMP CST. You only need either MAR or MU, not both.
ACC	O	Accumulated Interest and Principal - Numbers must be entered into P1/P2, n, i, PV, FV, and PMT. Press ACC to get the total principal paid from the first period entered to the second period entered into P1/P2. Press ACC again to get the total interest paid from the first period to the second period.

# Memory Functions

To use the memory functions in the Business Calculator, click the following buttons or press the keyboard equivalent.

<b>Button</b>	<b>Key</b>	<b>Description</b>
M1	CTRL+1	Display Memory Register 1
M2	CTRL+2	Display Memory Register 2
M3	CTRL+3	Display Memory Register 3
M4	CTRL+4	Display Memory Register 4
M5	CTRL+5	Display Memory Register 5
STO	CTRL+6	Store display in chosen memory register, replaces previous contents
M+	CTRL+7	Adds display to contents of chosen memory register

# Standard Calculator Functions

To use the standard calculator functions in the Business Calculator, click the following buttons or press the keyboard equivalent.

<b>Button</b>	<b>Key</b>	<b>Description</b>
CA	ESC	Clear All - clears the display plus all registers except the memory registers
C·CE	Delete	Clear - clears the display or the last entry - does not clear any registers. If you press this button twice, you will clear all operations since the last equal.
BACK	Backspace or left arrow	Backspace - deletes the last digit of the displayed number
$e^x$	X	Exponential - raises e to the power in the display
ln	L	Logarithm - calculates the natural log of the displayed number
n!	!	Factorial - calculates the factorial of the displayed number
%	%	Percent - converts the displayed number to a percent
$y^x$	^	Power - raises the number in the display to the power of the next number entered
SQRT	@	Square Root - calculates the square root of the displayed number
1/x	V	Inverse - calculates the inverse of the displayed number
$x^2$	Q	Square - calculates the square of the displayed number
/	/	Divide
x	*	Multiply
-	-	Subtract
.	.	Decimal - inserts a decimal point in the displayed number
+/-	CTRL+9	Change sign - changes the sign of the displayed number
+	+	Add
=	= or Enter	Equals - performs the operation between the previous two numbers

# Statistical Functions

To use the statistical functions in the Business Calculator, click the following buttons or press the keyboard equivalent.

Button	Key	Description
R	CTRL+R	Correlation coefficient - This is a regression parameter that may take on values between -1 and 1. A value close to 1 indicates a highly positive correlation, a value close to -1 indicates a highly negative correlation, and a value close to 0 indicates very little correlation between the two variables. This key is only valid in two-variable statistics.
a	CTRL+a	Intercept - This gives the y-intercept in the regression line estimated from the data. The line is of the form $y=a+bx$ . This key is only valid in two-variable statistics.
b	CTRL+b	Slope - This gives the slope of the regression line estimated from the data. The line is of the form $y=a+bx$ . This key is only valid in two-variable statistics.
X'	CTRL+X	X - This calculates the predicted value of the independent (x) variable for a given dependent (y) variable using the regression results. The value in the display is used as the dependent (y) variable. This key is only valid in two-variable statistics.
Y'	CTRL+Y	Y - This calculates the predicted value of the dependent (y) variable for a given independent (x) variable using the regression results. The value in the display is used as the independent (x) variable. This key is only valid in two-variable statistics.
STAT	CTRL+S	Statistics Box - enables the statistics functions.
Sum-x	CTRL+J	Sum of Xi's.
Sum-y	CTRL+K	Sum of Yi's - This key is only valid in two-variable statistics.
Sum-xy	CTRL+L	Sum of products of Xi and Yi - This is used in calculating the regression parameters (a and b). This key is only valid in two-variable statistics.
Sx	CTRL+D	Sample Standard Deviation of X - This gives the standard deviation using a population parameter of n-1. Square the result to get the variance.
Sy	CTRL+E	Sample Standard Deviation of Y - This gives the standard deviation using a population parameter of n-1. Square the result to get the variance. This key is only valid in two-variable statistics.
pSx	CTRL+P	Population Standard Deviation of X - This gives the standard deviation using a population parameter of n. Square the result to get the variance.
pSy	CTRL+Q	Population Standard Deviation of Y - This gives the standard deviation using a population parameter of n. Square the result to get the variance. This key is only valid in two-variable statistics.
Mx	CTRL+N	Mean of X - sample average.
My	CTRL+M	Mean of Y - sample average. This key is only valid in two-variable statistics.
(x,y)	,	Enters the independent (x) value when entering paired data. This key is only

valid in two-variable statistics.

DATA      d

Enters the sample point when entering non-paired data or the dependent (y) value when entering paired data.

## File Menu Commands

### Exit

Quits Business Calculator. Same as Application Control  
Close



## Application Control Menu Commands

To display the Application Control Menu, do one of the following

- Click the Application Control Menu box
- Press ALT+Space bar

**Restore** Returns the active window to its previous size.

**Move** Displays a four-headed arrow you can use with the direction keys to reposition an application window.

**Minimize** Shrinks an application window to an icon.

**Close** Closes an application window.

**Switch To** Switch to another open application.

## **Edit Menu Commands**

Copy

Copies a value onto clipboard

Paste

Pastes a value from Clipboard to Business Calculator's display or performs a calculator function.

# Copy

Copies a value onto clipboard.

Use this command when you want to copy a value and paste it into another application.

Related Topics

[Using Business Calculator with Clipboard](#)

## Paste

Pastes a value from clipboard to Business Calculator's display or performs a Calculator function.

Business Calculator interprets each character in clipboard as if the character were entered on the keyboard. When you paste from clipboard, Business Calculator interprets some characters as key sequences.

Related Topics

[Using Business Calculator with Clipboard](#)

## View Menu Commands

- Memory Registers** Choosing this option will bring up a dialog box which will list the contents of all five memory registers. Pressing Alt + M will also bring up the dialog box without going through the menu. Pressing Close will remove the box. Pressing Clear All within the dialog box will clear the memory registers.
- Financial Registers** Choosing this option will bring up a dialog box which will list the contents of the following nine financial registers: n, i, PV, FV, PMT, EFF, APR, period 1, and period 2 (P1 and P2). Pressing Alt + I will also bring up the dialog box without going through the menu. Pressing Close will remove the dialog box. Pressing Clear All within the dialog box will clear the displayed registers.
- Accounting Registers** Choosing this option will bring up a dialog box which will list the contents of the following four accounting registers: SEL, MAR, MU, and CST. Pressing Alt + A will also bring up the dialog box without going through the menu. Pressing Close will remove the dialog box. Pressing Clear All within the dialog box will clear the displayed registers.
- Calculator Tape** Choosing this option will bring up a box which is similar to an adding machine tape. It will show all operations from the time it is opened to the time it is closed. A copy of the tape may be printed to a printer or portions can be copied to another windows document using cut and paste. You can also edit the tape and the usual user interface keys for edit control are active. One important key sequence to remember is Ctrl-End. This sequence returns the cursor to the end of the tape. If you have been editing the tape and you fail to return the cursor to the end of the tape then the next operation will start where you have been editing instead of at the end.

# Time Value of Money Calculations

[Future Value Calculations](#)  
[Present Value Calculations](#)  
[Period Calculations](#)  
[Interest Rate Calculations](#)  
[Payment Calculations](#)

## Related Topics

[Accumulated Interest and Principal Calculations](#)  
[Calculating Effective Annual Rates and APR's](#)  
[Entering Uneven Cash Flows](#)  
[Internal Rate of Return of Analysis](#)  
[Loan Amortization Calculations](#)  
[Net Present Value Analysis](#)

# Calculating Future Values

## *Example*

Suppose you receive \$1000 on your 16th birthday. If you deposit the money in a savings account which earns 10% compounded annually, how much will you have on your 25th birthday?

### **Determining the variables**

**n** = 25 - 16 = 9 Since the interest is compounded annually, we just use the number of years.

**i** = 10

**PV** = \$1000

**PMT** = \$0

### **Entering the information and calculating FV**

1. Press CA to clear the registers.
2. Enter 9, then press n.
3. Enter 10, then press i.
4. Enter 1000, then press PV.
5. Since the registers are set to 0 when they are cleared, we do not need to do anything with payment. If you wish, however, you may enter 0, then press PMT.
6. Press COMP, then press FV.

**Answer:** 2357.947691

Note: All the calculations dealing with n, i, PV, and FV are simple growth problems that can be applied to many situations other than money.

## *Example*

In the fall semester of 1990, the University has an enrollment of 25,000. If there are 2 semesters per year and enrollment is expected to increase by 2% per semester, what will enrollment be in the fall semester of 1992 (4 semesters later)?

### **Determining the variables**

**n** = 4

**i** = 2

**PV** = 25,000

**PMT** = 0

### **Entering the information and calculating FV**

1. Press CA.

2. Enter 4, then press n.
3. Enter 2, then press i.
4. Enter 25000, then press PV.
5. Press COMP, then press FV.

**Answer:** 27,060.804

### Compounding Periods Other Than Annual

When compounding occurs more often than annually, we must divide the annual percentage rate (APR) by the number of compounding periods per year to get *i*. We must also multiply the number of years by the number of compounding periods to get *n*. The rate quoted by banks, finance companies, etc.. must be the APR, by law.

#### *Example*

Given a quoted rate of 10% and the following compounding periods, what should you use for *i*?

Compounding Period	<i>i</i>
Semiannually	$10/2 = 5$
Quarterly	$10/4 = 2.5$
Monthly	$10/12 = .833333333333333$
Weekly	$10/52 = .1923076923077$
Daily	$10/365 = .02739726027397$

#### *Example*

You deposit \$10,000 in a savings account for your daughter when she is born. If the savings account pays 5.5% compounded daily, how much will she have for college in 18 years?

### **Determining the variables**

**n** =  $18 * 365 = 6570$   
**i** =  $5.5/365 = .01506849315068$   
**PV** = 10,000  
**PMT** = 0

### **Entering the information and calculating FV**

1. Press CA.
2. Enter  $18 * 365 =$  , then press n.
3. Enter  $5.5 / 365 =$  , then press i.
4. Enter 10000, then press PV.
5. Press COMP, then press FV.

**Answer:** 26,910.337634



## Calculating FV with payments

### *Example*

You want to buy a house in 3 years, so you want to begin saving for the down payment today. You plan to deposit \$100 a month, beginning at the end of this month, in a savings account which earns 8% compounded monthly. How much will you have for the down payment in 3 years?

### **Determining the variables**

$$\begin{aligned}n &= 3 * 12 = 36 \\i &= 8 / 12 = .66666666666667 \\PV &= 0 \\PMT &= 100\end{aligned}$$

### **Entering the information and calculating FV**

1. Press CA.
2. Enter 36, then press n.
3. Enter 8 / 12 = , then press i.
4. Enter 100, then press PMT.
5. Remember that PV is already 0 since we cleared the registers.
6. Press COMP, then press FV.

**Answer:** 4053.55577431

### *Example*

Suppose you deposit \$1000 into a mutual fund today and will deposit \$500 a year, beginning 1 year from today, for 10 years. If the fund earns 9% per year, how much will you have in 10 years?

### **Determining the variables**

$$\begin{aligned}n &= 10 \\i &= 9 \\PV &= 1000 \\PMT &= 500\end{aligned}$$

### **Entering the information and calculating FV**

1. Press CA.
2. Enter 10, then press n.
3. Enter 9, then press i.
4. Enter 1000, then press PV.
5. Enter 500, then press PMT.
6. Press COMP, then press FV.

**Answer:** 9963.828533437

*Example*

Suppose a university wants to set up a scholarship fund. They invest \$100,000 at 12% compounded annually. If they withdraw \$10,000 a year beginning 1 year from today, how much will be in the account in 10 years?

**Determining the variables**

**n** = 10

**i** = 12

**PV** = 100,000

**PMT** = -10,000 Since you are withdrawing the payments, you need to enter the payment with a negative sign.

**Entering the information and calculating FV**

1. Press CA.
2. Enter 10, then press n.
3. Enter 12, then press i.
4. Enter 100000, then press PV.
5. Enter -10000, then press PMT
6. Press COMP, then press FV.

**Answer:** 130597.4701391

Annuity Dues

*Example*

Suppose you are saving money for a new car. If you deposit \$200 a month, beginning today, in an account which pays 12% compounded monthly, how much will you have in one year?

**Determining the variables**

**n** = 1 \* 12 = 12

**i** = 12/12 = 1

**PV** = 0

**PMT** = 200

**Entering the information and calculating FV**

1. Press CA.
2. Press BGN. This tells the calculator that the payments come at the beginning of the period.
3. Enter 12, then press n.
4. Enter 1, then press i.
5. Enter 200, then press PMT.

6. Press COMP, then press FV.

**Answer:** 2561.865608666

7. Press BGN. This changes the calculator back to a normal payment mode.

# Calculating Present Value

## Example

Suppose you know you are going to receive \$5000 in 5 years. If the going interest rate is 6% compounded annually, what is the \$5000 worth today?

### Determining the variables

**n** = 5  
**i** = 6  
**FV** = 5000  
**PMT** = 0

### Entering the information and calculating PV

1. Press CA to clear the registers.
2. Enter 5, then press n.
3. Enter 6, then press i.
4. Enter 5000, then press FV.
5. Since the registers are set to 0 when they are cleared, we do not need to do anything with payment. If you wish, however, you may enter 0, then press PMT.
6. Press COMP, then press PV.

**Answer:** 3736.29086433

### Compounding Periods Other Than Annual

When compounding occurs more often than annually, we must divide the annual percentage rate (APR) by the number of compounding periods per year to get *i*. We must also multiply the number of years by the number of compounding periods to get *n*. The rate quoted by banks, finance companies, etc... must be the APR, by law.

## Example

Given a quoted rate of 10% and the following compounding periods, what should you use for *i*?

Compounding Period	<i>i</i>
Semiannually	$10/2 = 5$
Quarterly	$10/4 = 2.5$
Monthly	$10/12 = .833333333333333$
Weekly	$10/52 = .1923076923077$
Daily	$10/365 = .02739726027397$

## Example

You need \$20,000 in five years for a down payment on a house. If a mutual fund earns 11% compounded quarterly, how much do you need to deposit today?

### **Determining the variables**

**n** =  $5 * 4 = 20$   
**i** =  $11 / 4 = 2.75$   
**FV** = 20,000  
**PMT** = 0

### **Entering the information and calculating PV**

1. Press CA.
2. Enter 20, then press n.
3. Enter  $11 / 4 = 2.75$ , then press i.
4. Enter 20000, then press FV.
5. Press COMP, then press PV.

**Answer:** 11625.01132642

Calculating PV with payments

### *Example*

You have just won the lottery. The jackpot is \$10 million which you will receive in yearly installments of \$500,000 per year for 20 years, beginning 1 year from today. The interest rate is 9% compounded annually. How much is the lottery actually worth today?

### **Determining the variables**

**n** = 20  
**i** = 9  
**FV** = 0  
**PMT** = 500,000

### **Entering the information and calculating PV**

1. Press CA.
2. Enter 20, then press n.
3. Enter 9, then press i.
4. Enter 500000, then press PMT.
5. Press COMP, then press PV.

**Answer:** 4564272.834543

Note: the following is a common problem in investments and corporate finance.

### Example

You want to purchase a corporate bond with a \$1000 face value. It pays an annual coupon of \$100 and matures in 15 years. The next coupon will be paid in 1 year. The yield to maturity on similar bonds is 12%. What is a fair price for this bond?

#### Determining the variables

**n** = 15  
**i** = 12  
**FV** = 1000  
**PMT** = 100

#### Entering the information and calculating PV

1. Press CA.
2. Enter 15, then press n.
3. Enter 12, then press i.
4. Enter 1000, then press FV.
5. Enter 100, then press PMT.
6. Press COMP, then press PV.

**Answer:** 863.7827102107

### Annuity Dues

#### Example

You are going to receive \$300 a month for the next 3 years. The first payment will be received today. The going interest rate is 6% compounded monthly. What is the value of this annuity?

#### Determining the variables

**n** =  $3 * 12 = 36$   
**i** =  $6 / 12 = .5$   
**FV** = 0  
**PMT** = 300

#### Entering the information and calculating PV

1. Press CA.
2. Press BGN. This tells the calculator that the payments come at the beginning of the period.
3. Enter 36, then press n.
4. Enter .5, then press i.
5. Enter 300, then press PMT.
6. Press COMP, then press PV.

**Answer:** 9910.611396138

7. Press BGN. This changes the calculator back to a normal payment mode.

The number of periods. The number of periods, the interest rate, and number of payments must agree.



The interest rate per period.

The present value of future cash flows based on a given rate of interest.

Equal cash flows which occur at the end of each period.

The value of cash flows at some point in the future.

This tells how often interest is applied. With compounding, you receive interest on interest which has been previously paid. This means the more compounding periods, the more you are actually earning.

An annuity due is when you have a series of equal payments with the payments coming at the beginning of the period instead of the end. An ordinary annuity has payments coming at the end of the period.

# Calculating the Number of Periods

## Example

If you deposit \$10,000 in a mutual fund earning 13% compounded annually, how long will it be before you double your money?

### Determining the variables

**i** = 13  
**PV** = 10,000  
**FV** =  $10,000 * 2 = 20,000$   
**PMT** = 0

### Entering the information and calculating n

1. Press CA to clear all the registers.
2. Enter 13, then press i.
3. Enter 10000, then press PV.
4. Enter 20000, then press FV.
5. Since the registers are set to 0 when they are cleared, we do not have to do anything with payment. You may, however, enter 0 , then press PMT.
6. Press COMP, then press n.

**Answer:** 5.67141716878

### Compounding periods other than annual

When compounding occurs more often than annually, we must divide the annual percentage rate (APR) by the number of compounding periods per year to get i. We must also multiply the number of years by the number of compounding periods to get n. The rate quoted by banks, finance companies, etc.... must be the APR, by law.

## Example

Given a quoted rate of 10% and the following compounding periods, what should you use for i?

Compounding Period	i
Semiannually	$10/2 = 5$
Quarterly	$10/4 = 2.5$
Monthly	$10/12 = .83333333333333$
Weekly	$10/52 = .1923076923077$
Daily	$10/365 = .02739726027397$

## Example

You need \$25,000 for a down-payment on a house. If you have \$15,000 today and can earn 8% compounded daily, how long will it take to get the \$25,000?

### **Determining the variables**

**i** =  $8 / 365 = .02191780821918$   
**PV** = 15,000  
**FV** = 25,000  
**PMT** = 0

### **Entering the information and calculating n**

1. Press CA.
2. Enter  $8 / 365 =$  , then press i.
3. Enter 15000, then press PV.
4. Enter 25000, then press FV.
5. Press COMP, then press n.

**Answer:** 2330.897311914

6. Remember this is in days, so to convert to years we take  $2330.897311914 / 365 = 6.386020032642$ .

Calculating n with payments

### *Example*

A corporate bond with a face value of 1000, an annual coupon of \$110, and a yield to maturity of 10% sells for \$1068.14. How many years until this bond matures?

### **Determining the variables**

**i** = 10  
**PV** = 1068.14  
**FV** = 1000  
**PMT** = 110

### **Entering the information and calculating n**

1. Press CA.
2. Enter 10, then press i.
3. Enter 1068.14, then press PV.
4. Enter 1000, then press FV.
5. Enter 110, then press PMT.
6. Press COMP, then press n.

**Answer:** 12.00101483236





# Calculating the Interest Rate

## *Example*

Suppose 6 years ago you deposited \$500 in an account which compounds interest on an annual basis. If there is \$1000 in the account today, what interest rate have you been earning?

### **Determining the variables**

**n** = 6  
**PV** = 500  
**FV** = 1000  
**PMT** = 0

### **Entering the information and calculating i**

1. Press CA to clear all the registers.
2. Enter 6, then press n.
3. Enter 500, then press PV.
4. Enter 1000, then press FV.
5. Since we cleared the registers, PMT is already 0. You may, however, enter 0, then press PMT.
6. Press COMP, then press i.

**Answer:** 12.24520483094

### Compounding periods other than annual

When compounding occurs more often than annually, we must divide the annual percentage rate (APR) by the number of compounding periods per year to get i. We must also multiply the number of years by the number of compounding periods to get n. The rate quoted by banks, finance companies, etc... must be the APR, by law.

## *Example*

Five years ago you deposited \$100 in a savings account. You now have \$149.14 in the account. If interest is compounded weekly, what is the annual percentage rate (APR)?

### **Determining the variables**

**n** =  $5 * 52 = 260$   
**PV** = 100  
**FV** = 149.14  
**PMT** = 0

### Entering the information and calculating i

1. Press CA.
2. Enter 260, then press n.
3. Enter 100, then press PV.
4. Enter 149.14, then press FV.
5. Press COMP, then press i.

**Answer:** .1538548800266

6. To convert to an APR you need to multiply by 52. i.e.  $.1538548800266 * 52 = 8.000453761383$

Calculating i with payments

#### *Example*

A corporate bond has the following characteristics: \$1000 face value; \$60 semiannual coupon; 10 years to maturity; \$1059.75 market price. If the next coupon payment is 6 months from today, what is the yield to maturity?

### Determining the variables

**n** =  $10 * 2 = 20$   
**PV** = 1059.75  
**FV** = 1000  
**PMT** = 60

### Entering the information and calculating i

1. Press CA.
2. Enter 20, then press n.
3. Enter 1059.75, then press PV.
4. Enter 1000, then press FV.
5. Enter 60, then press PMT.
6. Press COMP, then press i.

**Answer:** 5.500084216143

7. To get the yield to maturity we need to multiply by 2. i.e.  $5.500084216143 * 2 = 11.00016843229$

## Calculating Payments

When calculating payments,  $n$  and  $i$  must match the frequency of the payments. i.e. If payments occur monthly, then  $n$  should be the number of months and  $i$  should be the interest rate per month.

### *Example*

You are going to borrow \$75,000 to buy a house. If you take out a 30-year loan with an annual percentage rate (APR) of 9.5% and the first payment comes in 1 month, what is your monthly payment?

### **Determining the variables**

$$\begin{aligned} \underline{n} &= 30 * 12 = 360 \\ \underline{i} &= 9.5 / 12 = .7916666666667 \\ \underline{PV} &= 75,000 \\ \underline{FV} &= 0 \end{aligned}$$

### **Entering the information and calculating PMT**

1. Press CA to clear all the registers.
2. Enter 360, then press n.
3. Enter  $9.5 / 12 =$ , then press i.
4. Enter 75000, then press PV.
5. Since the registers have been cleared, FV is already 0. You may, however, enter 0, then press FV.
6. Press COMP, then press PMT.

**Answer:** 630.6406553841

### *Example*

If you need \$25,000 in 18 years for your child's education, how much do you need to save per week if the interest rate is 10% compounded weekly. You will make the first deposit in 1 week.

### **Determining the variables**

$$\begin{aligned} \underline{n} &= 18 * 52 = 936 \\ \underline{i} &= 10 / 52 = .1923076923077 \\ \underline{PV} &= 0 \\ \underline{FV} &= 25,000 \end{aligned}$$

### **Entering the information and calculating PMT**

1. Press CA.
2. Enter 936, then press n.

3. Enter 10 / 52 = , then press i.
4. Enter 25000, then press FV.
5. Press COMP, then press PMT.

**Answer:** 9.540587633684

### Annuity Dues

#### *Example*

Suppose you want to start saving for a new Mercedes. You estimate the cost of the car to be \$100,000 in 3 years. If you want to make monthly deposits, starting today, to an account which pays 15% compounded monthly, what should your payments be?

#### **Determining the variables**

**n** =  $3 * 12 = 36$   
**i** =  $15 / 12 = 1.25$   
**PV** = 0  
**FV** = 100,000

#### **Entering the information and calculating PMT**

1. Press CA.
2. Press BGN. This tells the calculator that payments occur at the beginning of the period.
3. Enter 36, then press n.
4. Enter 1.25, then press i.
5. Enter 100000, then press FV.
6. Press COMP, then press PMT.

**Answer:** 2189.168247328

7. Press BGN. This returns the calculator to the normal payment mode.

# Net Present Value Analysis

By definition, net present value is the present value of all future cash flow minus any initial investment. If you have a lump sum cash flow or an annuity, you can calculate the present value as discussed in Time Value of Money Calculations and then subtract the initial investment.

## Uneven Cash Flows

When the future cash flows are not the same each period you can use the CFT key to enter each period's cash flow. One thing to remember is you **MUST** begin with a cash flow at the beginning of the project, even if it is 0, and you can't skip any periods.

### *Example*

You are looking at a project which will cost \$100,000 and will pay \$20,000 at the end of the first year, \$40,000 at the end of the second year, \$80,000 at the end of the third year, and \$10,000 at the end of the fifth year. (No money will be received at the end of the fourth year.) If your cost of capital is 12%, what is the net present value?

### **Determining the variables**

**CF(0)** = -100,000 Cash outflows are always negative.

**CF(1)** = 20,000

**CF(2)** = 40,000

**CF(3)** = 80,000

**CF(4)** = 0

**CF(5)** = 10,000

**i** = 12

### **Entering the information and calculating NPV**

1. Press CA to clear all the registers or Clear All if the cash flow dialog box is open.
2. Enter -100000, then press CFT. This will bring up the cash flow dialog box which allows you to view the cash flows that have been entered.
3. Enter 20000, then press CFT.
4. Enter 40000, then press CFT.
5. Enter 80000, then press CFT.
6. Enter 0, then press CFT.
7. Enter 10000, then press CFT.
8. Enter 12, then press i.
9. Press NPV.

**Answer:** 12361.58634144

Consecutive periods with the same cash flows

*Example*

Your firm is looking at a project which will cost \$500,000 up front, will pay \$75,000 at the end of the first 5 years, pay \$50,000 at the end of the next 5 years, and will cost \$20,000 to be removed at the end of year 10. If your cost of capital is 15%, what is the net present value?

**Determining the variables**

**CF(0)** = -500,000  
**CF(1)-CF(5)** = 75,000 note that there are five of these  
**CF(6)-CF(9)** = 50,000 note that there are four of these  
**CF(10)** = 50,000 - 20,000 = 30,000

**Entering the information and calculating NPV**

1. Press CA or Clear All if the cash flow dialog box is open.
2. Enter -500000, then press CFt.
3. Enter 5, then press Nt. This tells the calculator that the next five periods have the same cash flow.
4. Enter 75000, then press CFt.
5. Enter 4, then press Nt.
6. Enter 50000, then press CFt.
7. Enter 30000, then press CFt.
8. Enter 15, then press i.
9. Press NPV.

**Answer:** -170201.3853794

Calculating present value with uneven cash flows

You can also use CFt, Nt, and NPV to calculate the present value of uneven cash flows.

*Example*

You are going to receive \$1000 bonus at the end of this month, \$500 bonus at the end of next month, and \$250 bonus at the end of the month after that. If the interest rate is 12% compounded monthly, what is the present value of your bonuses?

**Determining the variables**

**CF(0)** = 0  
**CF(1)** = 1000  
**CF(2)** = 500  
**CF(3)** = 250

## Entering the information and calculating PV

1. Press CA or Clear All if the cash flow dialog box is open.
2. Enter 0, then press Cft.
3. Enter 1000, then press Cft
4. Enter 500, then press Cft.
5. Enter 250, then press Cft.
6. Enter 1, then press i.
7. Press NPV. Since there is no initial cash outflow, the  $PV = NPV$ . If there had been an initial cash outflow you would add the amount to the NPV to get the PV.

**Answer:** 1722.894571586

Related Topics

[Entering Uneven Cash Flows](#)

[Internal Rate of Return Analysis](#)

[Time Value of Money Calculations](#)



# Internal Rate of Return Analysis

The internal rate of return of a stream of cash flows is the rate return which gives a net present value of 0.

## *Example*

Your company is considering a project which has an initial outlay of \$50,000. It will pay \$25,000 in 1 year, \$20,000 in 2 years, and \$15,000 in 3 years. What is the internal rate of return?

### **Determining the variables**

**CF(0)** = -50,000 cash outflows are always negative

**CF(1)** = 25,000

**CF(2)** = 20,000

**CF(3)** = 15,000

### **Entering the information and calculating IRR**

1. Press CA to clear all the registers or Clear All if the Cash Flow dialog box is already open.
2. Enter -50000, then press CFt. This will bring up the cash flow dialog box which allows you to see the cash flows which have been entered.
3. Enter 25000, then press CFt.
4. Enter 20000, then press CFt.
5. Enter 15000, then press CFt.
6. Press IRR.

**Answer:** 10.65168082714

## *Example*

A possible investment has the following cash flows: \$75,000 initial outlay and \$40,000 in years 1 through 3. What is the internal rate of return?

### **Determining the variables**

**CF(0)** = -75,000

**CF(1) - CF(3)** = 40,000 note there are three cash flows

### **Entering the information and calculating IRR**

1. Press CA or Clear All if the cash flow dialog box is still open.
2. Enter -75000, then press CFt.
3. Enter 3, then press Nt. This tells the calculator that the next three cash flows are the same.
4. Enter 40000, then press CFt.

5. Press IRR.

**Answer:** 27.75606691837

Note: An internal rate of return may not always exist or there may be more than one. This is particularly true if a cash outflow occurs at the beginning of the project and again at the end of the project. For this reason, some care should be used with internal rate of return analysis.

Related Topics

[Entering Uneven Cash Flows](#)

[Net Present Value Analysis](#)

The cost of capital is the interest paid on financing. It should be a function of the cost of debt, the cost of equity, and the risk of the project.

## Entering Uneven Cash Flows

The uneven cash flow keys are used in conjunction with Net Present Value Analysis and Internal Rate of Return Analysis. You always need to begin with the first period of the project. Generally this will be the initial outlay. If there is not cash flow in the first period you need to enter 0. You also need to make sure you enter a cash flow for every period, even if it is 0.

### *Example*

Enter the following cash flows

**CF(0)** = -50,000 cash outflows are negative

**CF(1)** = 25,000

**CF(2)** = 0

**CF(3)** = 30,000

### **Entering the information**

1. Press CA to clear all the registers or Clear All if the cash flow dialog box is open.
2. Enter -50000, then press CFt. This will bring up the cash flow dialog box.
3. Enter 25000, then press CFt.
4. Enter 0, then press CFt.
5. Enter 30000, then press CFt.

If you have consecutive cash flows which are equal, you don't have to enter each cash flow separately.

### *Example*

Enter the following cash flows.

**CF(0)** = 0

**CF(1) - CF(5)** = 20,000 note there are 5 cash flows

**CF(6)** = 15,000

### **Entering the information**

1. Press CA or Clear All if the cash flow dialog box is open.
2. Enter 0, then press CFt.
3. Enter 5, then press Nt. This tells the calculator that the next 5 cash flows are the same.
4. Enter 20000, then press CFt. Note that CF(1) through CF(5) show up in the dialog box with a value of 20000.
5. Enter 15000, then press CFt.

In the dialog box there are four buttons which can be used to edit the cash flows.

Button	Key	Function
Return	R	Switch back to the main calculator.
Load	L	Enter the currently selected cash flow into the Business Calculator's display.
Delete	D	Delete the currently selected cash flow from the box.
Clear All	C	Delete all the cash flows from the box. This must be done before a new set of cash flows can be entered.

Related Topics

[Net Present Value Analysis](#)

[Internal Rate of Return Analysis](#)

## Using Business Calculator with Clipboard

The Business Calculator can be used to supply calculated results to any application which makes use of the Clipboard.

To copy the number in Business Calculator's display to the Clipboard:  
Choose Copy from the Edit Menu.

To paste a number from the Clipboard to Business Calculator's display:  
Choose Paste from the Edit Menu.

Most characters on the Clipboard will be interpreted as if they were entered on the keyboard. The following is a description of some special characters.

Character	Pasted Text	Meaning
:		When placed before a character Business Calculator interprets the character as part of a control key sequence. For instance, :E is the same as CTRL + E.
{		Clears the display plus all the registers except the memory registers. It is the equivalent of CA or the ESC key.
}		Clears the display or the last entry. It is equivalent to the C-CE or the Delete key. If two } occur in a row, it will clear all operations since the last equal.

## Calculating Effective Annual Rates and APR's

An annual percentage rate (APR) is defined as the period interest rate multiplied by the number of compounding periods. Therefore, if interest is compounded monthly the APR is the monthly rate times 12. This is the rate that must be quoted by law.

An effective annual rate (EAR) takes into account the interest paid on interest. This implies that if interest is compounded more than once a year, then the EAR will be greater than the APR.

Converting from an APR to an EAR

### *Example*

Suppose you are given a loan with an APR of 13% compounded monthly. What interest rate are you effectively paying per year?

### **Entering the information and calculating APR**

1. Press CA to clear all the registers.
2. Enter 12, then press n. This tells the calculator how many compounding periods to use.
3. Enter 13, then press APR.
4. Press COMP, then press EFF.

**Answer:** 13.80324816139

Converting from EAR to APR

### *Example*

You are told you are effectively earning 10% on your money and that compounding occurs daily. What is the APR?

### **Entering the information and calculating APR**

1. Press CA.
2. Enter 365, then press n.
3. Enter 10, then press EFF.
4. Press APR.

**Answer:** 9.532262476476

Note if the compounding period is one year, the EAR and the APR will be equal.

# Accumulated Interest and Principal Calculations

With Business Calculator it is very easy to calculate how much interest and how much principal is paid during a given set of payments on a loan. First you need to enter the appropriate information into n, i, PV, FV, and PMT. Then you enter the beginning period and the ending period for the set of payments you are interested in. Finally, you use the ACC key to bring up the accumulated principal and accumulated interest.

## Example

You have a home mortgage with the following characteristics: Original loan amount = \$75,000; Interest rate = 10% compounded monthly; 30-year fixed rate. You are starting on your fifth year of payments and you wish to know what your total interest and principal payments will be this year.

### Determining the variables

**PV** = 75,000

**FV** = 0

**n** =  $30 * 12 = 360$

**i** =  $10 / 12 = .83333333333333$

**PMT** = this will be computed

**P1** =  $4 * 12 + 1 = 49$  This is the first payment in year 5. If the calculations for P1 and P2 don't make sense to you, write out what payments occur in each year beginning with year 1.

**P2** =  $5 * 12 = 60$

### Entering the information and calculating accumulated interest and principal

1. Press CA to clear all the registers.
2. Enter 75000, then press PV.
3. Since we cleared the registers, FV is already 0.
4. Enter 360, then press n.
5. Enter  $10 / 12 =$ , then press i.
6. Press COMP, then press PMT. Now all the information is available in these registers.
7. Enter 49, then press P1/P2.
8. Enter 60, then press P1/P2.
9. Press ACC.

**Answer:** 620.925026914

10. Notice that SUM-PRN appears in the box next to the display. This tells us that the number in the display is the sum of the principal payments.
11. Press ACC again.



**Answer:** 7277.219103885

12. Notice that SUM-INT appears in the box next to the display. This tells us that the number in the display is the total interest paid during this set of periods.

Related Topics

[Loan Amortization Calculations](#)

[Time Value of Money Calculations](#)

# Loan Amortization Calculations

The AMRT in conjunction with  $n$ ,  $i$ ,  $PV$ ,  $FV$ , and  $PMT$  make it very easy to set up an amortization schedule.

## *Example*

Your car loan has the following characteristics: Original loan amount = \$20,000; Interest rate = 11% compounded monthly; 4 year fixed rate. What is the amortization table for this loan?

### **Determining the variables**

**PV** = 20,000  
**FV** = 0  
**n** =  $4 * 12 = 48$   
**i** =  $11 / 12 = .91666666666667$   
**PMT** = will be computed

### **Entering the information and calculating the amortization table**

1. Press CA to clear all the registers.
2. Enter 20000, then press PV.
3. Since we cleared the registers, FV is already 0.
4. Enter 48, then press n.
5. Enter  $11 / 12 =$  , then press i.
6. Press COMP, then press PMT. Now all the information is available in these registers.
7. Press AMRT. The amortization table appears in a window.

The Business Calculator uses the Windows' Notepad program to display the amortization table. While in Notepad, you are able to edit the table by clicking the mouse anywhere in the table. Thus you are able to add an appropriate title or possibly display payment dates.

From within Notepad, the amortization table can be printed to the default printer, saved to a file, or selected areas of the table may be copied to the clipboard for pasting into other applications.

The amortization will display the interest rate per period and an APR with monthly compounding if the number of periods is divisible by 12. Otherwise, it will just give the period rate and the user needs to provide the APR in the table. The table also tells you whether you are working with an ordinary annuity or an annuity due.

An amortization table may also be displayed for when you are depositing money towards a desired future value, for example solving for a retirement fund.

Related Topics

Accumulated Interest and Principal Calculations  
Time Value of Money Calculations

## Cost, Selling Price, Margin, and Mark-up

This can be useful in determining the selling price, margin, mark -up, or cost, particularly in retail.

Determining the selling price

### *Example*

You want to know what the selling price of a T-shirt should be if the cost is \$6 and the usual mark-up is 110%.

### **Entering the information and calculating selling price**

1. Press CA to clear all the registers.
2. Enter 6, then press CST.
3. Enter 110, then press MU. Note MU (and MAR) are always entered as a percent.
4. Press COMP, then press SEL.

**Answer:**            12.6

### *Example*

Suppose you generally have a margin of 40%. If the cost of a pair of sunglasses is \$24, what should the selling price be?

### **Entering the information and calculating selling price**

1. Press CA.
2. Enter 40, then press MAR.
3. Enter 24, then press CST.
4. Press COMP, then press SEL.

**Answer:**            40

Determining Margin

### *Example*

Suppose you sell a brass picture frame for \$14.40 and it cost you \$6. What is your margin?

### **Entering the information and calculating margin**

1. Press CA.
2. Enter 14.4, then press SEL.
3. Enter 6, then press CST.

4. Press COMP, then press MAR.

**Answer:** 58.3333333333

Determining mark-up

*Example*

Suppose you sell a crystal vase for \$24 and it cost you \$10. What is your mark-up?

### **Entering the information and calculating mark-up**

1. Press CA.
2. Enter 24, then press SEL.
3. Enter 10, then press CST.
4. Press COMP, then press MU.

**Answer:** 140

Determining cost

*Example*

You are looking at a wicker basket which sells for \$12. If you know that the store uses a mark-up on wicker of 140%, what was their cost?

### **Entering the information and calculating cost**

1. Press CA.
2. Enter 12, then press SEL.
3. Enter 140, then press MU.
4. Press COMP, then press CST.

**Answer:** 5

*Example*

You know that a car dealer prices his cars with a margin of 15%. If the sticker price is \$12,500, what is his cost?

### **Entering the information and calculating cost**

1. Press CA.
2. Enter 15, then press MAR.
3. Enter 12500, then press SEL.
4. Press COMP, then press CST.

**Answer:** 10625

Margin is the percent of the selling price that is "profit."

Mark-up determines how much the selling price will be above the cost. i.e. If mark-up is 100%, then the selling price will be twice as much as the cost.

## Working with Memory Registers

The Business Calculator provides you with five memory registers where you can store a number for use in the future. To store a number in a memory register first press STO and then press the button for the memory register you want. For example, if you want to store the number in memory register 1, you would press STO M1. The number in the display will replace the number currently in the register.

You can add the number in the display to a number in one of the registers. This is done by first pressing M+ and then pressing the appropriate memory register.

To retrieve a number from a memory register, just press the memory register button. For example, if you want to use the number in memory register 1, just press M1.



## Performing Calculations

You will find the Business Calculator easy to use. With a mouse you just point and press the mouse button on the calculator buttons. The Business Calculator can also be used without a mouse by using the keyboard equivalents. For a list of the keyboard equivalents see [Keyboard](#). If you wish to use the numeric keypad to enter numbers and operators make sure that Num Lock is turned on.

To enter calculations, do the following:

1. Enter the calculation's first number. The display will show the number as you enter it. If you need to change the number use BACK to erase the last few digits, one at a time, or use C-CE to clear the whole number.
2. Enter the calculation's first operator.
3. Enter the next number.
4. Continue entering the numbers and operators, then press =. The answer will be displayed.

The Business Calculator does know the order of operations. This means it will multiply and divide before it will add and subtract. It will also do the square root, inverse, percent, log, power, factorial, exponential, and squared before it will multiply or divide. This is sometimes important to remember when entering your calculations.

# Advanced Calculator Functions

The Business Calculator has many advanced functions besides its business and statistical functions. They are not difficult to use, however, examples are presented below for each advanced function.

## Square Root

What is the square root of 10?

Enter 10, then press SQRT. The display should show 3.162277660168.

## Percent

What is 15 as a percent?

Enter 15, then press %. The display should show 0.15.

## Inverse

What is the inverse of 12?

Enter 12, then press  $1/x$ . The display should show .083333333333333

## Exponential

What is  $\exp(.75)$ ?

Enter .75, then press  $e^x$ . The display should show 2.117000016613.

## Natural Logarithm

What is the natural log of 5?

Enter 5, then press  $\ln$ . The display should show 1.609437912434.

## Factorial

What is 6 factorial?

Enter 6, then press  $n!$ . The display should show 720.

## Power

What is 6 raised to the 7 power?

Enter 6, press  $y^x$ , enter 7, then press =. The display should show 279936.

## Squared

What is 24 squared?

Enter 24, then press  $x^2$ . The display should show 576.

## Using Statistical Functions

The Business Calculator can perform some fairly sophisticated statistical procedures with a minimum of effort on your part. When you decide you wish to do a statistical analysis of a set of data the first thing you need to do is turn on the statistics mode. To do this you press STAT. This will bring up a dialog box which will show the data points as you enter them. For examples on entering data see [One Variable Statistical Analysis](#) and [Two Variable or Regression Analysis](#).

The dialog box has four buttons which allow you to edit the data points. The following is a list of the button, its keyboard equivalent, and its function.

Button	Key	Function
Return	R	Switch back to the main calculator.
Load	L	Enter the currently selected x data point from the statistics box into the display.
Delete	D	Delete the currently selected data from the statistics box.
Clear All	C	Delete all the data from the statistics box.

### Related Topics

[One Variable Statistical Analysis](#)

[Two Variable or Regression Analysis](#)

# One Variable Statistical Analysis

One variable statistical analysis will calculate the mean and the standard deviation of a set of numbers. It makes the assumption that the numbers are normally distributed.

## *Example*

You are a teacher and you want to know the mean and standard deviation of a group of test scores. You have the following set of scores: 99, 96, 87, 75, 68, 78, 98, 66, 72, 84.

## **Entering the information and calculating the mean and standard deviation**

1. Press STAT. This will bring up the statistics dialog box.
2. Enter 99, then press DATA. Notice in the statistics box that 99 appears as the first data point.
3. Enter 96, then press DATA.
4. Enter the rest of the scores in the same way.
5. Press Mx. This will display the mean score.

**Answer:** 82.3

6. Press pSx. This will give the standard deviation assuming this group of scores is the whole population. In other words, the sum of squares is divided by n. This estimator is unbiased.

**Answer:** 11.77327482054

7. Press Sx. This will give the standard deviation assuming this group of scores is a sample from the population. In other words, the sum of squares is divided by n-1. This estimator has the lowest mean square error.

**Answer:** 12.41012131734

Related Topics

[Two Variable or Regression Analysis Using Statistical Functions](#)

## Two Variable or Regression Analysis

This is used primarily to determine what kind of relationship there is between two different variables.

### *Example*

You want to know if there is a relationship between how your students score on the first exam and how they score on the second exam. Given the following sets of scores, do the statistical analysis.

Student	Exam 1	Exam 2
1	99	90
2	96	83
3	87	94
4	75	76
5	68	60
6	78	87
7	98	97
8	66	71
9	72	79
10	84	83

### **Entering the information and doing the analysis**

1. Press STAT. This brings up the statistics dialog box.
2. Enter 99, then press (x,y). This enters the first test score as the independent (x) variable.
3. Enter 90, then press DATA. This enters the second test score as the dependent (y) variable. Notice that the x and y variables now appear in the statistics dialog box.
4. Enter the rest of the data in the same manner.
5. Press Mx. This gives the mean of the first exam scores. The display should show **82.3**.
6. Press My. This gives the mean of the second exam scores. The display should show **82**.
7. Press pSx. This gives the standard deviation of the first exam scores assuming they are the whole population. This implies that the sum of squares is divided by n. This is an unbiased estimator. The display should show **11.77327482054**.
8. Press pSy. This gives the standard deviation of the second exam scores assuming they are the whole population. The display should show **10.53565375285**.
9. Press Sx. This gives the standard deviation of the first exam scores assuming they are a sample of the population. This implies that the sum of squares is divided by n-1. This is the estimator with the lowest mean square error. The display should show **12.41012131734**.
10. Press Sy. This gives the standard deviation of the second exam scores assuming they are a sample of the population. The display should

- show **11.10555416597**.
11. Press R. This gives the correlation between the two test scores. A value close to 1 implies strong positive correlation and a value close to -1 implies strong negative correlation. The display should show **.7965227297398**.
  12. Press a. This gives the y-intercept if we were to draw a regression line through the points. The display should show **23.33727725272**.
  13. Press b. This gives the slope of the regression line. The display should show **.7127912849001**.
  14. Enter 90, then press Y'. This gives the estimated value of the second exam score if the first exam score is 90. The display should show **87.48849289373**.
  15. Enter 85, then press X'. This gives the estimated value of the first exam score if the second exam score is 85. The display should show **86.50880566802**.

Sum- $x^2$ , Sum- $y^2$ , and Sum- $xy$  are used in calculating the numbers above. If you wish to know the value of the sum of  $x$  squared then press Sum- $x^2$ . If you wish to know the value of the sum of  $y$  squared then press Sum- $y^2$ . If you wish to know the value of the sum of  $x$  times  $y$  then press Sum- $xy$ .

Related Topics

[One Variable Statistical Analysis](#)  
[Using Statistical Functions](#)

## **Format Menu Command**

The Business Calculator allows you to set the number of decimal places that are displayed. Choose Format:Decimal Places from the menu bar. Select the number of decimal places you wish to display and press OK. If automatic is chosen, the Business Calculator will display the most accurate number of decimal places. Automatic is the default setting.



$g$  is the rate at which payments grow per period.

# Growing Annuities

## Calculating Present Value

### *Example*

You are thinking of buying a security which will make 5 annual payments beginning 1 year from today. The first payment is \$1000 and the payments will grow at 6% per year. If the market rate of interest is 10%, what is the present value of the security?

### **Determining the variables**

<b>n</b>	= 5
<b>FV</b>	= 0
<b>PMT</b>	= 1000
<b>g</b>	= 6
<b>i</b>	= 10

### **Entering the information and calculating PV**

1. Press CA to clear all the registers.
2. Enter 5, then press n.
3. Since we cleared the registers, FV is already 0.
4. Enter 1000, then press PMT.
5. Enter 6, then press g.
6. Enter 10, then press i.
7. Press COMP, then press PV.

**Answer:** 4,226.680095125

### Annuity Dues

### *Example*

Look back at the example above. Assume that the first payment occurs today instead of in 1 year.

### **Determining the variables**

<b>n</b>	= 5
<b>FV</b>	= 0
<b>PMT</b>	= 1000
<b>g</b>	= 6
<b>i</b>	= 10

### **Entering the information and calculating PV**

1. Press CA to clear all the registers.

2. Enter 5, then press n.
3. Enter 1000, then press PMT.
4. Enter 6, then press g.
5. Enter 10, then press i.
6. Press BGN to tell the calculator that the payment occurs at the beginning of the period.
7. Press COMP, then press PV.

**Answer:** 4,649.348104638

8. Press BGN to return the calculator to normal mode.

## Calculating Future Value

### *Example*

You have just left an old job and received \$10,000 in pension benefits. To avoid taxes you have decided to have the money deposited in your new employers pension fund. In addition, 5% of your annual income will be deposited into the fund at the end of each year, beginning 1 year from today. The first payment is based on a salary of \$35,000 and is expected to grow at an annual rate of 4%. The fund earns 12% per year. If payments will be made for 15 years, how much money will you have in the fund in 15 years?

### **Determining the variables**

<b>n</b>	= 15
<b>PV</b>	= 10,000
<b>PMT</b>	= 35,000 * .05 = 1750
<b>g</b>	= 4
<b>i</b>	= 12

### **Entering the information and calculating FV**

1. Press CA.
2. Enter 15, then press n.
3. Enter 10,000, then press PV.
4. Enter 1750, then press PMT.
5. Enter 4, then press g.
6. Enter 12, then press i.
7. Press COMP, then press FV.

**Answer:** 135,074.2693934

To calculate the future value when the first payment occurs at the beginning of the period, press BGN before computing FV.

## Calculating Payments

### *Example*

You wish to have \$20,000 in 10 years. You plan on making your first deposit in 1 year and will increase your deposits by 5% per year. If the money will earn 8% interest, how much do you need to deposit in 1 year?

### **Determining the variables**

**n** = 10  
**PV** = 0  
**FV** = 20,000  
**g** = 5  
**i** = 8

### **Entering the information and calculating PMT**

1. Press CA.
2. Enter 10, then press n.
3. Enter 20,000, then press FV.
4. Enter 5, then press g.
5. Enter 8, then press i.
6. Press COMP, then press PMT.

**Answer:** 1,132.010604297

If the first payment were to occur at the beginning of the period, you would press BGN before COMP PMT.

## Date Calculations Procedures

**Number of Days** This procedure computes the number of days between a beginning date and an ending date.

**Compute Ending Day** This procedure computes an ending date based on the number of days given. The number of days can be positive (forward) or negative (backward) number.

**NOTE:**

The computation does take leap years into consideration.  
The dates must be between the years 1900 and 2035.

# **Time Value of Money Procedures**

Time value of money procedures are concerned with the value or price put on time.

Future Value Procedure

Present Value Procedure

Payment Required Procedure

Interest Rate Earned Procedure

# Option Pricing Procedures

Options are contractual agreements that give the owner the right to buy an asset (CALL) or to sell an asset (PUT) on or before a given date at a fixed price.

**Call Options** - This procedure will compute the value of a call option using the Black-Scholes option pricing model.

**Put Options** - This procedure will compute the value of a put option using the Black-Scholes option pricing model.

## INPUT:

**Asset Price** - The current price of the asset.

**Exercise Price** - The fixed price which the option holder can buy or sell the underlying asset.

**Volatility** - The variance (per year) of the continuous return on the underlying asset.

**Risk-Free Rate** - This is the risk-free rate of return (annualized).

**Expiration Date** - This is the maturity date of the option.

## NOTES:

**Cash Flow** - If cash flows are expected to occur on the asset during the life of the option, then the asset price should be the current price minus the present value of the expected cash flows.

**Type** - The Black-Scholes formula is designed for European options. Therefore, it fails to account for the early exercise premium on American options.

**Moneyness** - The Black-Scholes formula works best for options that are near the money (the stock price is close to the exercise price).

# Loan Amortization Procedure

This procedure will allow you to compute the payment required for a loan and create a loan amortization schedule.

Simply enter the required information on the screen and press **Compute** to find the required payment. Press **Schedule** to display the loan amortization schedule. The loan amortization schedule will be displayed using the Windows' Notepad program. The Notepad program allows you to print and edit the loan amortization schedule as well.

## INPUT:

- Loan Amount** - Enter the dollar amount of the loan.
- Total Periods** - This is the number of total periods expected (**NOT** the number of periods per year).
- Payment Period** - This is the frequency that payments are made. Payments can be made daily (365/year), weekly (52/year), biweekly (26/year), monthly (12/year), bimonthly (6/year), quarterly (4/year), semiannually (2/year), annually (1/year).
- Payment Method** - Payments can be made at the beginning of the period (Advance) or the payment can be made at the end of the period (Arrears).
- Compounding Period** - This is the frequency that interest payments are reinvested.
- Future Value** - This is the dollar amount of some future sum that is to be reached.
- Annual Rate** - This is the annual percentage rate (APR) or the nominal annual interest rate.
- Description** - This field may be used to describe the loan such as a person's name or the address of the property.

## NOTES:

Since the Notepad program has a file size limit, the number of payments cannot exceed 700.

The beginning and ending dates must be between the years 1900 and 2035.



## Future Value Procedure

This procedure will compute the value of a single deposit or a series of payments which are invested for a particular number of periods.

### INPUT:

- Initial Deposit -** The initial dollar amount deposited on the beginning date.
- Total Periods -** This is the number of total periods expected (**NOT** the number of periods per year).
- Payment Period -** This is the frequency that payments are made. Payments can be made daily (365/year), weekly (52/year), biweekly (26/year), monthly (12/year), bimonthly (6/year), quarterly (4/year), semiannually (2/year), annually (1/year).
- Payment Method -** Payments can be made at the beginning of the period (Advance) or the payment can be made at the end of the period (Arrears).
- Payment Amount -** This is the dollar amount of a series of payments.
- Compounding Period -** This is the frequency that interest payments are reinvested.
- Annual Rate -** This is the annual percentage rate (APR) or the nominal annual interest rate.

### NOTE:

The beginning and ending dates must be between the years 1900 and 2035.

## Present Value Procedure

This procedure will compute the current value of a future lump sum or a series of payments which are invested for a particular number of periods.

### INPUT:

**Final Lump Sum** - The dollar amount of a final lump sum payment made on the ending date.

**Total Periods** - This is the number of total periods expected (**NOT** the number of periods per year).

**Payment Period** - This is the frequency that payments are made. Payments can be made daily (365/year), weekly (52/year), biweekly (26/year), monthly (12/year), bimonthly (6/year), quarterly (4/year), semiannually (2/year), annually (1/year).

**Payment Method** - Payments can be made at the beginning of the period (Advance) or the payment can be made at the end of the period (Arrears).

**Payment Amount** - This is the dollar amount of a series of payments.

**Compounding Period** - This is the frequency that interest payments are reinvested.

**Annual Rate** - This is the annual percentage rate (APR) or the nominal annual interest rate.

### NOTE:

The beginning and ending dates must be between the years 1900 and 2035.

## Payment Required Procedure

This procedure will compute the payment amount required to reach some future sum.

### INPUT:

- Loan Amount -** If this is a loan, enter the dollar amount of the loan. If this is an annuity, enter 0.0 for the amount.
- Total Periods -** This is the number of total periods expected (**NOT** the number of periods per year).
- Payment Period -** This is the frequency that payments are made. Payments can be made daily (365/year), weekly (52/year), biweekly (26/year), monthly (12/year), bimonthly (6/year), quarterly (4/year), semiannually (2/year), annually (1/year).
- Payment Method -** Payments can be made at the beginning of the period (Advance) or the payment can be made at the end of the period (Arrears).
- Future Value -** This is the dollar amount of some future sum that is to be reached.
- Compounding Period -** This is the frequency that interest payments are reinvested.
- Annual Rate -** This is the annual percentage rate (APR) or the nominal annual interest rate.

### NOTE:

The beginning and ending dates must be between the years 1900 and 2035.

## Interest Rate Earned Procedure

This procedure will compute the annual rate and the effective rate for an investment that is liquidated at the end of the specified period.

### INPUT:

- Amount Invested -** This is the dollar amount of the investment.
- Amount Returned -** This is the total dollar amount returned from the investment.
- Total Periods -** This is the number of total periods expected (**NOT** the number of periods per year).
- Compounding Period -** This is the frequency that interest payments are reinvested.

### OUTPUT:

- Annual Rate -** This is the annual percentage rate (APR) or the nominal annual interest rate.
- Effective Rate -** This is the effective annual interest rate (EAR).

### NOTE:

The beginning and ending dates must be between the years 1900 and 2035.



