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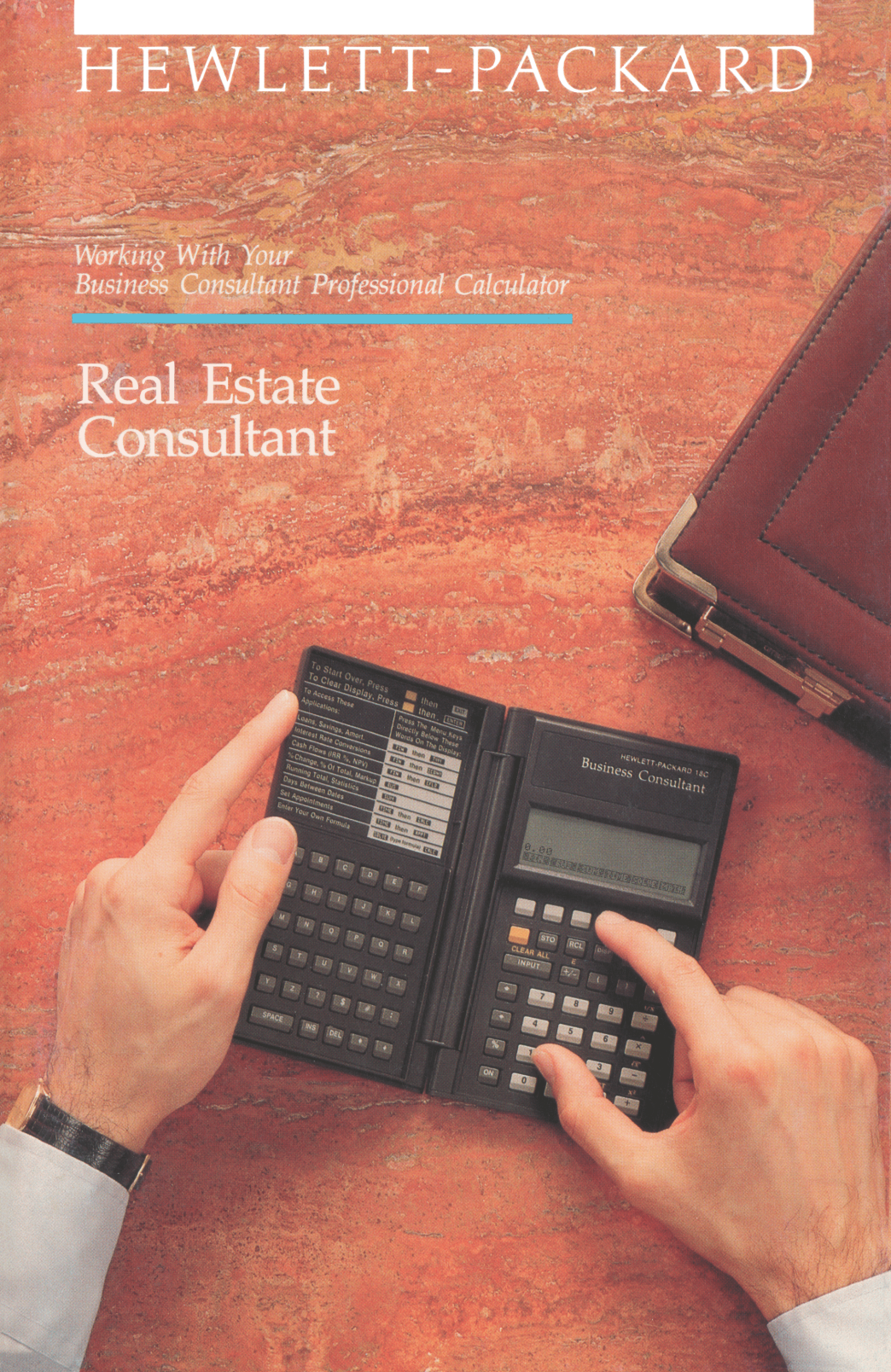
Working With Your
Business Consultant Professional Calculator

Real Estate Consultant



Real Estate Consultant

Business Consultant
Professional Calculator

Edition 2 November 1986
Reorder Number 00018-90040

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Corvallis, OR 97330, U.S.A.

Printing History

Edition 1	April 1986	Mfg. No. 00018-90050
Edition 2	November 1986	Mfg. No. 00018-90066

Welcome...

... to the Consultant applications series! This series is designed to help you get the most from your Business Consultant professional calculator.

The purpose of the *Real Estate Consultant* is to provide a set of keystrokes and routines to assist you in making real estate investment decisions. These routines can be used by brokers, investors, appraisers, analysts, and others who need to make financial decisions about real estate transactions. The *Real Estate Consultant* is designed to serve as a reference to many of your real estate problems, and show you how your Business Consultant can help.

Before you use the solutions in this book, you should be familiar with certain concepts from the owner's manual:

- Chapter 1: The basics of your calculator—how to move from menu to menu, identify and move to the MAIN menu, and use the menu keys to do calculations.
- Chapter 4: The Time Value of Money (TVM menu) and the cash flow sign convention (cash paid out is entered as a negative number and cash received is entered as a positive number).
- Chapter 5: Entering cash flows.
- Chapter 9: Entering and using formulas.

The examples in this book show two decimal places. If your display is set to something other than two, the answers in your display will not match exactly what is in this book. Refer to your owner's manual for more information about changing the number of decimal places.

For more information about the topics in the *Real Estate Consultant,* refer to a basic textbook on the subject. Specific references on the more specialized topics are included with the formula.

Contents

When Entering Formulas...

When entering formulas into your Business Consultant, follow the instructions in chapter 9 of your owner's manual. Here are hints to help you in common error situations:

1. If the calculator displays `INVALID FORMULA` when you press CALC, the calculator does not understand something in the formula. When the formula returns to the screen, the cursor is positioned where your calculator detected the error. Check the formula in the screen against the formula in the book. Make sure the parentheses match and that the operators are where they should be.
2. If the calculator accepts the formula but your answer does not match the example, check the values stored in the menu key variables by recalling them (press RCL, then the menu key). If the values are correct, return to the SOLVE menu and check the formula. (Press EXIT to return to the SOLVE menu and press EDIT to view and edit the formula.) Check the formula against the one in this book for accuracy. When you find an error, edit the formula and press CALC to display the custom menu again.
3. If the calculator displays `INSUFFICIENT MEMORY` when you press INPUT or CALC, you must free portions of memory. Refer to page 189 of the owner's manual for additional information.

The formulas in the *Real Estate Consultant* use variable names that are intended to remind you of what to store. Feel free to change them to something more meaningful to you.

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Basic Mortgage Components

Many of the analytical techniques illustrated in this book require that you know certain basic mortgage components. For a particular problem, some of these values may not be known. However, if any three elements are known (mortgages with balloon payments have four known elements), the remaining unknown value can be calculated.

The basic financial functions are summarized below for quick reference. Refer to Chapter 4 (Time Value of Money) in the owner's manual for additional information.

Storing Financial Data

Key	Value Stored
N	Total number of payments.
I%YR	Annual interest rate as a percent.
PV	Initial loan balance.*
PMT	Periodic payment.*
FV	Future value or balloon payment.*
#P/Y	Number of payments per year.
END	Sets End mode.
BEG	Sets Begin mode.

* Use the cash flow sign convention.

Solving for Values

Unknown Value	Known Values Required to Solve
N	I%YR, PV, PMT, FV,* #P/Y, End or Begin
I%YR	N, PV, PMT, FV,* #P/Y, End or Begin
PV	N, I%YR, PMT, FV,* #P/Y, End or Begin
PMT	N, I%YR, PV, FV,* #P/Y, End or Begin
FV	N, I%YR, PV, PMT, #P/Y, End or Begin

* FV is zero if there is no balloon payment.

Example 1. A broker lists a property that has an assumable loan. The original loan amount was $150,000 at 7% annual interest, fully amortized with monthly payments in 25 years. The loan originated 11 years and 8 months ago. What is the loan balance?

Solution. The broker needs to know the monthly payment to calculate the loan balance. The known basic mortgage components are the original number of payments (N), the annual interest (I%YR), and the original balance (PV). There is no balloon payment, so FV=0. The monthly payment (PMT) is unknown. The balance can be calculated as a balloon payment (FV) due after 11 years and 8 months (140 payments). The broker must first calculate the monthly payment, then use the four known values (N, I%YR, PV, and PMT) to calculate the amount of the balloon payment.

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER		Displays secondary TVM menu.
CLEAR ALL		Sets 12 payments per year; End mode.
EXIT		Displays TVM menu.
25 × 12 N	N=300.00	Stores total number of payments.
7 I%YR	I%YR=7.00	Stores annual interest rate.
150000 PV	PV=150,000.00	Stores original loan amount.
PMT	PMT=-1,060.17	Calculates monthly payment amount.
11 × 12 + 8 N	N=140.00	Calculates and stores number of payments already made.
FV	FV=-110,080.32	Calculates loan balance.

Example 2. A property has an existing loan of $100,000 with monthly payments of $1,106.20 for 30 years. What is the annual interest rate of the loan?

Solution. The interest rate is the unknown value. The loan amount, remaining number of payments, and monthly payment are known.

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER		Displays secondary TVM menu.
CLEAR ALL		Sets 12 payments per year; End mode.
EXIT		Displays the TVM menu.
30 × 12 N	N=360.00	Stores total number of payments.
100000 PV	PV=100,000.00	Stores loan amount.
1106.20 +/− PMT	PMT=-1,106.20	Stores monthly payment. (Remember to use the sign convention.)
I%YR	I%YR=13.00	Calculates annual interest rate.

Example 3. What is the balloon payment due at the end of year 10 for a $750,000 loan with monthly payments of $9,483.33 and a 15% annual interest rate?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER		Displays secondary TVM menu.
CLEAR ALL		Sets 12 payments per year; End mode.
EXIT		Displays the TVM menu.
10 × 12 N	N=120.00	Stores total number of payments.
15 I%YR	I%YR=15.00	Stores annual interest rate.
750000 PV	PV=750,000.00	Stores loan amount.
9483.33 +/− PMT	PMT=-9,483.33	Stores payment amount.
FV	FV=-720,185.74	Calculates amount of balloon payment.*

* The balloon payment amount occurs coincident with, and does not include, the last periodic payment amount.

Example 4. Mr. Seller takes a $200,000 purchase money mortgage at 12% annual interest with quarterly payments and a $150,000 balloon payment due at the end of five years. What is the quarterly payment?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER		Displays secondary TVM menu.
4 #P/Y END		Sets 4 payments per year; End mode.
EXIT		Displays the TVM menu.
5 × 4 N	N=20.00	Stores total number of payments.
12 I%YR	I%YR=12.00	Stores annual interest rate.
200000 PV	PV=200,000.00	Stores loan amount.
150000 +/- FV	FV=-150,000.00	Stores balloon payment amount.
PMT	PMT=-7,860.79	Calculates quarterly payment amount.

Example 5. A loan at 15% annual interest, with monthly payments of $1,283.62, has a balloon payment of $100,000 due at the end of year 10. What is the remaining balance if the loan is paid in full at the end of the sixth year?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER		Displays secondary TVM menu.
CLEAR ALL		Sets 12 payments per year; End mode.
EXIT		Displays the TVM menu.
10 − 6 × 12 N	N=48.00	Stores total number of remaining payments.
15 I%YR	I%YR=15.00	Stores annual interest rate.
1283.62 +/− PMT	PMT=-1,283.62	Stores monthly payment amount.
100000 +/− FV	FV=-100,000.00	Stores amount of balloon payment.
PV	PV=101,208.02	Calculates loan balance at the end of year 6.

Price to Pay for a Mortgage

Mortgages can be bought or sold at prices lower (*discounted*) or higher (*at a premium*) than the remaining balance of the loan. Given the amount of the mortgage, the periodic payment, the timing and amount of the balloon payment, and the desired yield rate, the price of the mortgage can be found. The price to pay for an existing mortgage is the present value of the remaining periodic payments and the balloon payment, discounted at the investor's required yield.

Information is entered as follows. Remember to use the cash flow sign convention (money paid out is negative, money received is positive).

1. From the MAIN menu, press FIN, then TVM.
2. Clear the TVM variables, store the number of payments per year in #P/Y, and set the payment mode (Begin or End, as appropriate).
3. Store the total number of payments in N.
4. Store the desired annual yield (interest rate) in I%YR.
5. Store the periodic payment amount in PMT. If you do not know the payment amount, it must be calculated using the actual interest rate stated in the loan. Refer to examples 2 and 3.
6. If a balloon payment exists, store the amount in FV. The balloon payment amount occurs coincident with, and does not include, the last periodic payment amount. If you do not know the amount of the balloon payment, it must be calculated. Refer to example 3.
7. Press PV to calculate the purchase price of the mortgage.

Example 1. A lender wishes to induce the borrower to prepay a low interest rate loan. There are 72 payments remaining of $137.17 and a balloon payment at the end of the sixth year of $2000. If the lender is willing to discount the future payments at 9%, how much would he accept as full repayment of the loan?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
72 N	N=72.00	Stores number of payments.
9 I%YR	I%YR=9.00	Stores discount rate.
137.17 PMT	PMT=137.17	Stores monthly payment.
2000 FV	FV=2,000.00	Stores balloon payment amount.
PV	PV=-8,777.61	Calculates amount necessary to prepay the note.

Example 2. A 9½% mortgage with 26 years remaining and a balance of $49,350 is available for purchase. Determine the price to pay for this mortgage if the desired yield is 12%. (Since the payment amount is not given, it must be calculated.)

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
26 × 12 N	N=312.00	Stores number of payments.
9.5 I%YR	I%YR=9.50	Stores annual interest rate.
49350 +/− PV	PV=-49,350.00	Stores current mortgage balance.
PMT	PMT=427.17	Calculates monthly payment to be received.
12 I%YR	I%YR=12.00	Stores desired yield.
PV	PV=-40,801.57	Calculates purchase price to achieve the desired yield.

Example 3. A $1,000,000, 9% loan with a 30-year amortization, has a balloon payment in 5 years. How much should you pay for this loan to yield 13%?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
30 × 12 N	N=360.00	Stores number of payments.
9 I%YR	I%YR=9.00	Stores annual interest rate.
1000000 +/− PV	PV=-1,000,000.00	Stores loan amount.
PMT	PMT=8,046.23	Calculates monthly payment amount.
5 × 12 N	N=60.00	Stores number of payments in 5 years.
FV	FV=958,801.36	Calculates balloon payment due at the end of the fifth year.
13 I%YR	I%YR=13.00	Stores desired yield.
PV	PV=-855,923.45	Calculates purchase price to achieve 13% yield.

Yield of a Mortgage Traded at a Discount or Premium

The annual yield of a mortgage bought at a discount or premium can be calculated given the original mortgage amount, interest rate, periodic payment, balloon payment amount (if it is other than zero), and the price paid for the mortgage.

Information is entered as follows. Remember to use the cash flow sign convention (money paid out is negative, money received is positive).

1. From the MAIN menu, press FIN, then TVM.
2. Clear the TVM variables, store the number of payments per year in #P/Y, and set the payment mode (Begin or End, as appropriate).
3. Store the total number of payments in N.
4. Store the purchase price of the mortgage in PV.
5. Store the periodic payment amount in PMT. If you do not know the payment amount, it must be calculated. Refer to examples 1 and 2.
6. If a balloon payment exists, store the amount in FV. The balloon payment amount occurs coincident with, and does not include, the last periodic payment amount. If you do not know the amount of the balloon payment, it must be calculated. Refer to example 2.
7. Press I%YR to calculate the annual yield.

Example 1: Yield of a Discounted Mortgage. An investor wishes to purchase a $100,000 mortgage taken out at 9% for 20 years. Since the mortgage was issued, 42 monthly payments have been made. What is the yield if the purchase price of the mortgage is $79,000? (Since the payment amount is not given, it must be calculated.)

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
20 × 12 N	N=240.00	Stores the number of payments.
9 I%YR	I%YR=9.00	Stores annual interest rate.
100000 +/− PV	PV=-100,000.00	Stores mortgage amount.
PMT	PMT=899.73	Calculates the monthly payment to be received.
RCL N	N=240.00	Recalls number of payments.
− 42 N	N=198.00	Calculates and stores number of payments remaining.
79000 +/− PV	PV=-79,000.00	Stores purchase price of mortgage.
I%YR	I%YR=11.65	Calculates percent annual yield.

Example 2: Yield of a Discounted Mortgage with Balloon Payment. Using the information given in example 1, calculate the annual yield if the loan is to be paid in full at the end of the fifth year (5 years from when the mortgage was issued). (In this case, both the payment amount and the balloon payment amount must be calculated.)

These steps are necessary if you have not done example 1.

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
CLEAR ALL	0.00	Clears TVM variables.
20 × 12 N	N=240.00	Stores the number of payments.
9 I%YR	I%YR=9.00	Restores annual interest rate.
100000 +/− PV	PV=-100,000.00	Restores mortgage amount.
PMT	PMT=899.73	Calculates the monthly payment to be received.
5 × 12 N	N=60.00	Stores number of payments in five years.
FV	FV=88,707.05	Calculates balloon payment amount due in five years.
RCL N − 42 N	N=18.00	Stores new life of loan.
79000 +/− PV	PV=-79,000.00	Stores price of mortgage.
I%YR	I%YR=20.72	Calculates percent annual yield.

APR of a Loan With Fees

The Annual Percentage Rate (APR) incorporates the fact that fees are usually charged when a mortgage is issued, which raises the interest rate. The actual amount received by the borrower (PV) is reduced, while the periodic payments remain the same. Given the life or term of the mortgage, the interest rate, the mortgage amount, and the basis of the fee charged (how the fee is calculated), the Annual Percentage Rate (APR) can be calculated.

Information is entered as follows. Remember to use the cash flow sign convention (money paid out is negative, money received is positive).

1. From the MAIN menu, press FIN, then TVM.
2. Clear the TVM variables, store the number of payments per year in #P/Y, and set the payment mode (Begin or End, as appropriate).
3. Store the total number of payments in N.
4. Store the payment amount in PMT.
5. Store the balloon payment plus any prepayment penalties in FV.
6. Subtract any origination fees from the loan amount and store the result (the net proceeds) in PV.
7. Press I%YR to calculate the annual percentage rate.

Example 1. A borrower is charged two points for the issuance of his mortgage. (One point is equal to 1% of the mortgage amount.) If the mortgage amount is $60,000 for 30 years and the interest rate is 11½%, with monthly payments, what APR is the borrower paying?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
30 × 12 N	N=360.00	Stores number of payments.
11.5 I%YR	I%YR=11.50	Stores annual interest rate.
60000 PV	PV=60,000.00	Stores loan amount.
PMT	PMT=-594.17	Calculates monthly payment.
RCL PV − 2 % PV	PV=58,800.00	Stores actual amount received by borrower.
I%YR	I%YR=11.76	Calculates annual percentage rate.

Example 2. Using the information given in example 1, calculate the APR if the mortgage fee is stated as $150 instead of as a percentage.

These steps are necessary if you have not done example 1.

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
CLEAR ALL	0.00	Clears TVM variables.
30 × 12 N	N=360.00	Stores number of payments.
11.5 I%YR	I%YR=11.50	Restores annual interest rate.
60000 PV	PV=60,000.00	Restores loan amount.
PMT	PMT=-594.17	Calculates monthly payment.
RCL PV −		Stores actual amount
150 PV	PV=59,850.00	received.
I%YR	I%YR=11.53	Calculates APR.

Example 3. Using the information given in example 1 again, what is the APR if the mortgage fee is stated as 2 points plus $150?

These steps are necessary if you have not done examples 1 or 2.

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
CLEAR ALL	0.00	Clears TVM variables.
30 × 12 N	N=360.00	Stores number of payments.
11.5 I%YR	I%YR=11.50	Restores annual interest rate.
60000 PV	PV=60,000.00	Restores loan amount.
PMT	PMT=-594.17	Calculates monthly payment.
RCL PV − 2 % − 150		Stores actual amount borrowed.
PV	PV=58,650.00	
I%YR	I%YR=11.80	Calculates APR.

Example 4. A $1,000,000, 10-year, 12% interest-only loan has an origination fee of 3 points. What is the yield to the lender? Assume that monthly payments are made. (The monthly payment amount must first be calculated. The balloon payment is the entire loan amount, or $1,000,000.)

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
10 × 12 N	N=120.00	Stores number of payments.
1000000 × 12 % ÷	120,000.00÷	Calculates amount of annual interest.
12 +/− PMT	PMT=−10,000.00	Calculates and stores monthly payment.
1000000 +/− FV	FV=−1,000,000.00	Stores balloon payment.
− 3 % = +/− PV	PV=970,000.00	Calculates and stores actual amount borrowed.
I%YR	I%YR=12.53	Calculates APR.

Mortgage Measure Calculations

Debt Coverage Ratio (DCR)

The *debt coverage ratio* (DCR) is calculated by dividing the net operating income by the annual debt service. Lenders use the DCR as a measure of safety in loan underwriting since it compares property income to the amount needed to meet loan payment obligations. Given constant net operating income, the DCR decreases as the annual debt service increases.

Formula:

$$DCR = \frac{NOI}{ADS}$$

where: DCR = debt coverage ratio
NOI = net operating income
ADS = annual debt service

Entering and Using the DCR Formula:

1. From the MAIN menu, press SOLVE to display the SOLVE menu.
2. Type in the DCR formula as follows:

   DCR=NOI÷ADS
3. Press CALC to verify the formula and to display the DCR custom menu.
4. Store two of the following variables:

   - Debt coverage ratio in DCR.
   - Net operating income in NOI.
   - Annual debt service in ADS.
5. Press the menu key of the unknown variable to calculate its value.

Example 1: The NOI from a property is estimated to be $6,400 per year. There are two mortgages on the property. The first has monthly payments of $325 and the second has quarterly payments of $647. What is the DCR?

Start from the DCR custom menu.

Keys:	Display:	Description:
6400 NOI	NOI=6,400.00	Stores NOI.
325 × 12 + (647 × 4)		Stores total annual debt service.
ADS	ADS=6,488.00	
DCR	DCR=0.99	Calculates DCR.

Example 2. A lender specifies a minimum DCR of 1.15 for a property with a NOI of $100,000. What is the maximum monthly loan payment amount the lender will receive from the property?

Start from the DCR custom menu.

Keys:	Display:	Description:
100000 NOI	NOI=100,000.00	Stores NOI.
1.15 DCR	DCR=1.15	Stores DCR.
ADS	ADS=86,956.52	Calculates ADS.
÷ 12 =	7,246.38	Divides the ADS by 12 to calculate the monthly payment amount.

Example 3. A lender agrees to a 15% loan with monthly payments and a 30-year amortization. The minimum DCR is 1.25. What is the maximum loan amount for a property with a NOI of $150,000 per year?

Start from the DCR custom menu.

Keys:	Display:	Description:
1.25 DCR	DCR=1.25	Stores DCR.
150000 NOI	NOI=150,000.00	Stores NOI.
ADS	ADS=120,000.00	Calculates ADS.
÷ 12 = STO 0	10,000.00	Calculates monthly payment and stores amount in register 0.
MAIN FIN TVM		Displays the TVM menu to calculate the loan amount.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
RCL 0 PMT	PMT=10,000.00	Stores monthly payment amount.
15 I%YR	I%YR=15.00	Stores remaining values.
30 × 12 N	N=360.00	
PV	PV=-790,861.42	Calculates loan amount.

Annual Loan Constant (ALC)

The *annual loan constant* (also called loan constant or annual debt constant) is calculated by dividing the annual debt service (ADS) by the loan amount. The annual loan constant is defined as the ratio of the ADS to the loan amount for a loan of $1. The loan constant is usually converted to a percentage rounded to two decimal places by using a loan amount of $100 to calculate the ALC.

Formula:

$$\text{ALC} = \frac{\text{ADS}}{\text{Loan Amount}} \times 100$$

where: ALC = annual loan constant (as a percent)
ADS = annual debt service

Entering and Using the ALC Formula:

1. From the MAIN menu, press SOLVE to display the SOLVE menu.
2. Type in the ALC formula as follows:

   ALC=(ADS÷LOAN)×100
3. Press CALC to verify the formula and to display the ALC custom menu.
4. Store two of the following variables:

   - Annual loan constant in ALC.
   - Annual debt service in ADS.
   - Loan amount in LOAN.
5. Press the menu key of the unknown variable to calculate its value.

Example 1. A $250,000 loan has an annual debt service of $30,858.36. What is the ALC?

Start from the ALC custom menu.

Keys:	Display:	Description:
250000 LOAN	LOAN=250,000.00	Stores known values.
30858.36 ADS	ADS=30,858.36	
ALC	ALC=12.34	Calculates annual loan constant.

Example 2. A loan of $275,000 has an annual loan constant of 12.85%. What is the monthly payment amount?

Start from the ALC custom menu.

Keys:	Display:	Description:
275000 LOAN	LOAN=275,000.00	Stores known values.
12.85 ALC	ALC=12.85	
ADS	ADS=35,337.50	Calculates annual debt service.
÷ 12 =	2,944.79	Calculates monthly payment amount.

Example 3. What is the annual loan constant for a $100,000, 25-year loan with quarterly payments and a 14% annual interest rate?

Start from the ALC custom menu.

Keys:	Display:	Description:
MAIN		Displays the MAIN menu.
FIN TVM		Displays the TVM menu to calculate the ADS.
CLEAR ALL OTHER 4 #P/Y END EXIT		Clears the financial variables, sets 4 payments per year, and End mode.
100000 +/-		Stores known values.
PV	PV=-100,000.00	
25 × 4 N	N=100.00	
14 I%YR	I%YR=14.00	
PMT	PMT=3,615.93	Calculates quarterly payment.
× 4 =	14,463.71*	Calculates annual debt service.
MAIN SOLVE		Displays the SOLVE menu. The list pointer should point to the ALC formula.
CALC		Displays custom menu.
STO ADS	ADS=14,463.71	Stores known values.
100000 LOAN	LOAN=100,000.00	
ALC	ALC=14.46	Calculates annual loan constant.

* At this point, instead of displaying the SOLVE menu, you could calculate the ALC with these keystrokes:

RCL PV ÷ 100 ×

Adjustable Rate Mortgages

An *adjustable rate mortgage* is a mortgage loan that provides for the adjustment of its interest rate as market interest rates change. As the interest rate changes, the amount of the periodic payment changes to reflect the new interest rate.

Given the terms of the original mortgage, the changes in the interest rate, and the time frame in which the changes occur, this procedure calculates the amount of each periodic payment. Once each payment is known, the APR of the entire transaction can be calculated.

Information is entered as follows. Remember to use the cash flow sign convention (money paid out is negative, money received is positive).

1. From the MAIN menu, press FIN, then TVM.
2. In the TVM menu, calculate the amount of the initial monthly payment.
3. Calculate the loan balance just before payments increase the first time, change the sign, and store the result in PV.
4. Change the interest rate, adjust the term, store 0 in FV, and recalculate the monthly payment.
5. Calculate the loan balance before payments increase the next time, change the sign, and store the result in PV.
6. Repeat steps 4 and 5 until all payments have been calculated.
7. Use IRR% in the CALC menu for CFLO lists to calculate the APR.

Example 1. A $50,000, 30-year, adjustable rate mortgage has the following terms:

12% interest in first year
13% interest in second and third years
15% interest for the remaining term

What are the monthly payments?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
30 × 12 N	N=360.00	Stores total number of payments.
12 I%YR	I%YR=12.00	Stores initial annual interest rate.
50000 +/− PV	PV=−50,000.00	Stores loan amount.
PMT	PMT=514.31	Calculates payment amount in first year.
12 N	N=12.00	Stores number of payments at initial interest rate.
FV	FV=49,818.56	Calculates the loan balance after 12 payments.

+/- PV	PV=-49,818.56	Stores remaining balance as new loan amount.
29 × 12 N	N=348.00	Stores remaining number of payments.
13 I%YR	I%YR=13.00	Stores new interest rate.
0 FV	FV=0.00	Sets loan balance to zero.
PMT	PMT=552.70	Calculates payment in second and third years.
24 N	N=24.00	Stores number of payments at new interest rate.
FV	FV=49,464.37	Calculates remaining balance after the next 24 payments.
+/- PV	PV=-49,464.37	Stores remaining balance as new loan amount.
27 × 12 N	N=324.00	Stores remaining number of payments.
15 I%YR	I%YR=15.00	Stores new annual interest rate.
0 FV	FV=0.00	Sets loan balance to zero.
PMT	PMT=629.55	Calculates payment for remaining term.

Example 2. Given the payments in example 1, calculate the APR.

Start from the TVM menu.

Keys:	Display:	Description:
EXIT CFLO		Displays the CFLO menu.
CLEAR ALL YES		Clears the list.
50000 +/− INPUT		Stores initial cash flow.
514.31 INPUT 12 INPUT		Stores first cash flow group.
552.70 INPUT 24 INPUT		Stores second cash flow group.
629.55 INPUT 27 × 12 INPUT		Stores third cash flow group.
CALC		Displays the CALC menu.
IRR%	IRR%=1.18	Calculates monthly IRR%.
× 12 =	14.13	Calculates APR.

Graduated Payment Mortgages

The Graduated Payment Mortgage is designed to meet the needs of homebuyers who currently cannot afford high mortgage payments, but who have the potential of increased earnings in the years to come.

Under the Graduated Payment Mortgage plan, the payments increase by a fixed percentage at the end of each year for a specified number of years. Thereafter, the payment amount remains constant for the remaining life of the mortgage. The result is that in the early years the borrower pays a payment that is less than a traditional mortgage payment at the same rate, and in the later years makes larger payments than he would with a traditional loan.

Given the term of the mortgage (in months), the annual interest rate, the loan amount, the percentage that the payments increase, and the number of years that the payments increase, the following formulas calculate the first monthly payment, as well as subsequent payments. The GPMT formula can be modified to accommodate other than monthly payments by changing the constant 12 to the number of payments per year.

Entering and Using the GPMT and PMT Formulas:

1. From the MAIN menu, press SOLVE to display the SOLVE menu.
2. Type in the GPMT formula as follows. Since the formula is quite long, you may need to clear memory before keying it in. Refer to page 188 in the owner's manual for information on clearing memory.

```
GPMT=PV÷(USPV(I÷12:12)×USFV((((1+%I÷100)÷
(1+I÷1200)^12)-1)×100:#YR)+
((USPV(I÷12:N-12×#YR)×(1+%I÷100)^#YR)÷
SPFV(I÷12:12×#YR)))
```

3. Press INPUT to verify the formula.

4. Type in the PMT formula to compute subsequent payments.

   PMT=RND(GPMT:2)×(1+%I÷100)^(#YR-1)

5. Press [INPUT] to verify the formula.
6. Press [↑] [CALC] to designate GPMT as the current formula and display the custom menu.
7. Store the following variables:
   - Loan amount in [PV].
   - Annual interest rate (as a percentage) in [I].
   - Percentage increase in the monthly payment in [%I].
   - Number of years that payments increase in [#YR].
   - Total number of payments in [N].
8. Press [GPMT] to calculate the monthly payment amount.
9. Press [EXIT] [↓] [CALC] to designate PMT as the current formula and display the custom menu.
10. Store the year number in [#YR].
11. Press [PMT] to calculate the monthly payment amount in the specified year.*

* The PMT formula shares variables with the GPMT formula. You must store variables in the GPMT formula and calculate the amount of the monthly graduated payment before calculating subsequent payments with the PMT formula.

Example. A couple purchased a new house with a Graduated Payment Mortgage. The loan is for $50,000 over a period of 30 years at an annual interest rate of 12.5%. The monthly payments will be graduating at an annual rate of 5% for each of the first 5 years and then will be level for the remaining 25 years. What is the amount of the monthly payment in the first year? How much are the monthly payments in each subsequent year?

Start from the GPMT custom menu.

Keys:	Display:	Description:
50000 PV	PV=50,000.00	Stores known values.
30 × 12 N	N=360.00	
12.5 I	I=12.50	
5 %I	%I=5.00	
5 #YR	#YR=5.00	
GPMT	GPMT=448.88	Calculates monthly payment in first year.
EXIT ↓ CALC		Moves to the PMT formula to compute subsequent payments.
2 #YR PMT	PMT=471.32	Calculates monthly payment for year 2.
3 #YR PMT	PMT=494.89	Calculates monthly payment for year 3.
4 #YR PMT	PMT=519.63	Calculates monthly payment for year 4.
5 #YR PMT	PMT=545.62	Calculates monthly payment for year 5.
6 #YR PMT	PMT=572.90	Calculates monthly payment for years 6–30.

Amortization Schedule With Unequal Payments

In situations where either the periodic payment amount or the annual interest rate (or both) can change, it is possible to generate an amortization schedule. You must know the amount of the loan, the interest rates, the amount of each payment, and the number of payments at each interest rate.

Information is entered as follows. Remember to use the cash flow sign convention (money paid out is negative, money received is positive).

1. From the MAIN menu, press FIN, then TVM.
2. Store the initial loan information (the loan amount, annual interest rate, and periodic payment amount) in the TVM menu. (If the payment amount is not known, it can be calculated by also storing the total number of payments in N and then pressing PMT.)
3. Press OTHER AMRT to display to the amortization menu.
4. Key in the number of payments to amortize and press #P. The interest and balance are displayed. Repeat this step until all payments at this amount and interest rate are amortized.
5. Press BAL EXIT EXIT STO PV to store the remaining balance as the new loan amount in the TVM menu.
6. Store the adjusted annual interest rate in I%YR and the new periodic payment amount in PMT.
7. Repeat steps 3–6 until the schedule is complete.

Example 1. A $50,000, 30-year, adjustable rate mortgage has the following terms:

12 payments at 12% interest; PMT=$514.31
24 payments at 13% interest; PMT=$552.70
324 payments at 15% interest; PMT=$629.55

Generate a yearly amortization schedule for the first 3 years.

Start from the MAIN menu.

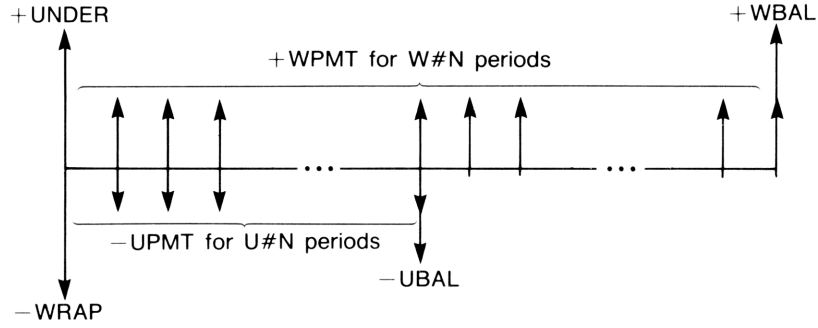
Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
12 I%YR 50000 +/- PV 514.31 PMT	I%YR=12.00 PV=-50,000.00 PMT=514.31	Stores initial loan information.
OTHER AMRT		Displays amortization menu.
12 #P	BALANCE= -49,818.51 INTEREST= 5,990.23	Calculates interest and remaining balance for the first 12 months.
BAL EXIT EXIT		Returns to TVM menu with remaining balance in the calculator line.
STO PV	PV=-49,818.51	Stores remaining balance as new loan amount.
13 I%YR 552.70 PMT	I%YR=13.00 PMT=552.70	Stores adjusted interest rate and payment amount.
OTHER AMRT		Displays amortization menu.
12 #P	BALANCE= -49,652.87 INTEREST= 6,466.76	Calculates interest and remaining balance for the next 12 months (year 2).
12 #P	BALANCE= -49,464.37 INTEREST= 6,443.90	Calculates interest and remaining balance for year 3.

Wrap-Around Loans

A wrap-around loan is a loan that is partially funded by an existing underlying loan. Instead of refinancing the existing loan, the wrap-around borrower receives the difference between the wrap-around loan amount and the underlying loan balance. The borrower gives up the original loan and receives a new one. The wrap-around lender collects the loan payment on the wrap-around loan and makes the payment on the underlying loan. The wrap-around lender's net investment is the difference between the wrap-around loan amount and the underlying loan balance. In return for this net investment, the wrap-around lender receives the difference between the loan payment on the wrap-around loan and the loan payment of the underlying loan, plus the difference in balloon payments if the loans are repaid before full amortization.

The most common wrap-around loan calculations involve the yield on the lender's net investment (YLD) and the interest rate required on the total wrap-around loan to achieve a given yield on the lender's net investment. The following information must be known about both the wrap-around loan and the underlying loan: total number of payments, payment amount, loan amount, and amount of any balloon payments. If any of this information is unknown, you need to calculate it using the TVM menu.

The cash flow diagram of a wrap-around loan (from the wrap-around lender's point of view) can be drawn as follows:



where: WRAP = total amount of wrap-around loan
UNDER = remaining balance of underlying loan
WPMT = wrap-around loan monthly payment
W#N = number of monthly payments in wrap-around loan
UPMT = underlying loan monthly payment
U#N = number of monthly payments in underlying loan
WBAL = wrap-around loan balloon payment
UBAL = underlying loan balloon payment

The following formula calculates the variables of a wrap-around loan with monthly payments. The formula can be modified to accommodate other than monthly payments by changing the constant 12 to the number of payments per year.

Entering and Using the WRAP Formula:

1. Calculate any unknown mortgage values (either for the wrap-around loan or the underlying loan) using the TVM menu.
2. From the MAIN menu, press SOLVE to display the SOLVE menu.
3. Type in the WRAP formula as follows.

```
WRAP-WPMT×(USPV(YLD÷12;W#N))-WBAL×
(SPPV(YLD÷12;W#N))=UNDER-UPMT×
(USPV(YLD÷12;U#N))-UBAL×(SPPV(YLD÷12;U#N))
```

4. Press CALC to verify the formula and to display the custom menu.

5. Store or calculate the following variables:

- Total amount of wrap-around loan in WRAP.
- Monthly payment of wrap-around loan in WPMT.
- Number of monthly payments in wrap-around loan in W#N.
- Balloon payment of wrap-around loan in WBAL.
- Annual yield to the lender in YLD.
- Remaining balance of underlying loan in UNDER.
- Monthly payment of underlying loan in UPMT.
- Number of monthly payments in underlying loan in UPMT.
- Balloon payment of underlying loan in UBAL.

Example 1. A mortgage loan on an income property has a current balance of $200,132.06. When the loan originated eight years ago, it had a 20-year term with full amortization in level monthly payments at 6.75% interest.

A lender has agreed to 'wrap' a $300,000 second mortgage at 10%, with full amortization in equal monthly payments over 12 years. What is the yield to the lender on the net cash advanced? (The monthly payment amount for each mortgage must be calculated before proceding to the WRAP custom menu.)

Start from the MAIN menu.

Keys:	**Display:**	**Description:**
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
20 − 8 × 12 N	N=144.00	Stores known values of underlying loan.
200132.06 +/− PV	PV=-200,132.06	
6.75 I%YR	I%YR=6.75	

PMT STO 0	PMT=2,031.55	Calculates underlying monthly payment and stores value in register 0.
300000 +/-		Stores known values of wrap-around loan.
PV	PV=-300,000.00	
10 I%YR	I%YR=10.00	
PMT STO 1	PMT=3,585.23	Calculates wrap-around monthly payment and stores value in register 1.
MAIN SOLVE CALC		Displays the SOLVE menu and custom WRAP menu. (You may need to use ↓ to move the list pointer to the WRAP formula before pressing CALC .)

Start from the WRAP custom menu.

300000 WRAP	WRAP=300,000.00	Stores wrap-around loan values.
RCL 1 WPMT	WPMT=3,585.23	
12 × 12 W#N	W#N=144.00	
0 WBAL	WBAL=0.00	
MORE		Displays second set of menu labels.
200132.06		Stores underlying loan values.
UNDER	UNDER=200,132.06	
12 × 12 U#N	U#N=144.00	
RCL 0 UPMT	UPMT=2,031.55	
0 UBAL	UBAL=0.00	
MORE YLD	YLD=15.85*	Displays first set of menu labels and calculates annual nominal yield to the lender.

* The solver searches for a numerical solution and displays intermediate estimates.

Example 2. A customer has an existing loan with a balance of $125,010, a remaining term of 200 months, and a $1,051.61 monthly payment. He wishes to obtain a $200,000, 9½% wrap-around with 240 monthly payments of $1681.71, and a balloon payment at the end of the 240th month of $129,963.35. If you, as a lender, accept the proposal, what is your rate of return?

Start from the WRAP custom menu.

Keys:	Display:	Description:
200000 WRAP	WRAP=200,000.00	Stores wrap-around loan known values.
1681.71 WPMT	WPMT=1,681.71	
240 W#N	W#N=240.00	
129963.35 WBAL	WBAL=129,963.35	
MORE		Displays second set of menu labels.
125010 UNDER	UNDER=125,010.00	Stores underlying loan known values.
200 U#N	U#N=200.00	
1051.61 UPMT	UPMT=1,051.61	
0 UBAL	UBAL=0.00	
MORE		Displays first set of menu labels.
YLD	YLD=11.84*	Calculates annual yield to lender.

Example 3. Your firm has determined that the yield on a wrap-around loan should be 12% annually. Continuing from example 2, what monthly payment must be received to achieve this yield on a $200,000 wrap-around loan? What interest rate is the borrower paying? (Assume that the balloon payment on the wrap-around does not change, only the payment amount changes.)

* The solver searches for a numerical solution and displays intermediate estimates.

Continue from example 2.

Keys:	Display:	Description:
12 YLD	YLD=12.00	Stores desired annual yield.
WPMT	WPMT=1,693.97	Calculates amount of wrap-around monthly payment.
STO 0 RCL WBAL STO 1	WBAL=129,963.35	Stores wrap monthly payment and remaining balance in registers 0 and 1 respectively.
MAIN FIN TVM		Displays TVM menu to calculate interest rate paid by borrower.
CLEAR ALL OTHER		
CLEAR ALL EXIT		
RCL 0 +/- PMT	PMT=-1,693.97	Stores information on wrap-around loan.
240 N	N=240.00	
200000 PV	PV=200,000.00	
RCL 1 +/- FV	FV=-129,963.35	
I%YR	I%YR=9.58	Calculates annual interest paid by borrower.

Biweekly Mortgage Payments

One way to pay off your mortgage at a faster rate is to make biweekly mortgage payments. Instead of making one payment each month, you pay one-half of the monthly payment every two weeks. This way you make 26 or 27 payments each year (depending on the date of each payment), increase your equity, and pay less interest.*

Information is entered menu as follows:

1. From the MAIN menu, press FIN, then TVM. Remember to use the cash flow sign convention (money paid out is negative, money received is positive).
2. Clear the TVM variables, store 12 in #P/Y, and set End mode.
3. Store the total number of monthly payments in N.
4. Store the annual interest rate in I%YR.
5. Store the loan amount in PV.
6. Press PMT to calculate the monthly payment.
7. Divide the monthly payment by 2 to calculate the biweekly payment amount. Store the biweekly payment amount in PMT.
8. For other TVM calculations using the biweekly payment amount, you will need to store the number of payments made each year in #P/Y before continuing. (Refer to example 2.)

* This procedure is based on information provided by City Savings Bank of Meriden, Meriden, Connecticut.

Example 1. On a $75,000, 30-year, 13.5% mortgage, what is the amount of the biweekly payment?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
75000 PV 30 × 12 N 13.5 I%YR	PV=75,000.00 N=360.00 I%YR=13.50	Stores known values.
PMT	PMT=-859.06	Calculates monthly payment amount.
÷ 2 = PMT	PMT=-429.53	Calculates and stores biweekly payment amount.

Example 2. Continuing from example 1, with this biweekly payment amount, how long will it take to pay off the mortgage?

Keys:	Display:	Description:
OTHER 26 #P/Y EXIT		Stores number of payments each year.
N	N=457.85	Calculates number of biweekly payments.
÷ 26 =	17.61	The loan is amortized between the 17th and 18th years.

Example 3. Continuing from examples 1 and 2, if 27 payments are made in the first year, how much interest is paid? What is the remaining balance?

Keys:	Display:	Description:
OTHER AMRT		Displays amortization menu.
27 #P	PAYMENTS:1-27 BALANCE= 73,840.76 INTEREST= -10,438.07	Calculates interest and remaining balance for payments 1-27.

Canadian Mortgages

In Canada, interest is compounded semi-annually with payments made monthly. This results in a different monthly mortgage factor than is used in the United States and preprogrammed into the Business Consultant. This difference can be handled by first calculating the Canadian mortgage factor, and then storing that value as I%YR. Another option is to create a custom menu to calculate Canadian mortgages. This is described on page 54.

To calculate the Canadian mortgage factor:

1. From the MAIN menu, press FIN, then TVM. Remember to use the cash flow sign convention (money paid out is negative, money received is positive).
2. Clear the TVM variables, store 12 in #P/Y, and set End mode.
3. Store 6 in N.
4. Store 200 in PV.
5. Calculate 200 plus the annual interest rate, change the sign to a negative number, and store the value in FV.
6. Press I%YR to calculate the Canadian mortgage factor.

The following examples show how this factor is used for I%YR in Canadian mortgage problems.

Example 1. What is the monthly payment required to fully amortize a 30-year, $30,000 Canadian mortgage if the interest rate is 12%?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
6 N	N=6.00	Calculates the Canadian mortgage factor.
200 PV	PV=200.00	
+ 12 = +/-		
FV	FV=-212.00	
I%YR	I%YR=11.71	
30 × 12 N	N=360.00	Stores known mortgage values.
30000 PV	PV=30,000.00	
0 FV	FV=0.00	
PMT	PMT=-301.92	Calculates monthly payment.

Example 2. A Canadian mortgage has monthly payments of $612.77 at 8.75% interest. The principal amount is $75,500. What will be the outstanding balance at the end of 10 years?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
6 N	N=6.00	Calculates Canadian mortgage factor.
200 PV	PV=200.00	
+ 8.75 = +/-		
FV	FV=-208.75	
I%YR	I%YR=8.59	
612.77 +/-		Stores known values.
PMT	PMT=-612.77	
10 × 12 N	N=120.00	
75500 PV	PV=75,500.00	
FV	FV=-61,877.18	Calculates balance remaining at the end of ten years.

The following formula creates a custom menu to calculate Canadian mortgages.

Entering and Using the CANADA Formula:

1. From the MAIN menu, press SOLVE to display the SOLVE menu.
2. Type in the CANADA formula as follows.

```
CANADA:PV=-PMT×USPV(((1+CI%YR÷200)^
(1÷6)-1)×100:N)-FV×SPPV(((1+CI%YR÷200)^
(1÷6)-1)×100:N)
```

3. Press CALC to verify the formula and to build a custom menu.
4. Store or calculate the following variables:
   - Loan amount or present value in PV.
   - Periodic payment amount in PMT.
   - Annual interest rate as a percent in CI%YR.
   - Total number of payments in N.
   - Remaining balance or future value in FV.

Example 3. What is the monthly payment required to fully amortize a 30-year, $50,000 Canadian mortgage if the interest rate is 9%?

Start from the CANADA custom menu.

Keys:	Display:	Description:
30 × 12 N	N=360.00	Stores known values.
9 CI%YR	CI%YR=9.00	
50000 PV	PV=50,000.00	
0 FV	FV=0.00	
PMT	PMT=-396.42	Calculates monthly payment.

Example 4. A Canadian mortgage has monthly payments of $612.77 with a maturity of 25 years. The principal amount is $75,500. What is the annual interest rate?

Start from the CANADA custom menu.

Keys:	Display:	Description:
612.77 [+/-]		Stores known values.
PMT	PMT=-612.77	
75500 PV	PV=75,500.00	
25 [×] 12 N	N=300.00	
0 FV	FV=0.00	
CI%YR	CI%YR=8.75*	Calculates annual interest rate.

* The solver searches for a numerical solution and displays intermediate estimates.

Modified Internal Rate of Return

When there is more than one sign change (positive to negative or negative to positive) in a series of cash flows, there is a potential for more than one IRR%. For example, the cash flow sequence in example 1 has three sign changes and hence up to three potential internal rates of return. (This particular example has three positive real answers: 1.86, 14.35, and 29.02% monthly.)

The Modified Internal Rate of Return (MIRR) procedure is an alternative that can be used when your cash flow situation has multiple sign changes. The procedure eliminates the sign change problem by utilizing reinvestment and borrowing rates that you specify. Negative cash flows are discounted at a 'safe' rate that reflects the return on an investment in a liquid account. The figure generally used is a short-term security (T-bill) or bank passbook rate. Positive cash flows are reinvested at a 'reinvestment' rate that reflects the return on an investment of comparable risk. An average return rate on recent market investments might be used.*

The steps in the procedure are:

1. From the MAIN menu, press CFLO to display the cash flow menu.
2. In the CFLO menu, calculate the present value of the negative cash flows (NPV) at the safe rate and store the result in register 0. Key in 0 for any cash flow that is positive.
3. Calculate the future value of the positive cash flows (NFV) at the reinvestment rate and store the result in register 1. Key in 0 for any cash flow that is negative.
4. In the TVM menu, store the total number of periods in N, the present value of the negative cash flows in PV, and the future value of the positive cash flows in FV.
4. Press I%YR to calculate the periodic interest rate.

* Reinvestment rates and safe rates are based on current and expected capital market yields and the investor's financial management strategy. We assume that after-tax cash flows and yields will be used when applying this technique.

Example 1. An investor has the following investment opportunity. The cash flows are:

Group	# Months	Cash Flow ($)
0	1	−180,000
1	5	100,000
2	5	−100,000
3	9	0
4	1	200,000

Calculate the MIRR using a safe rate of 8% and a reinvestment (risk) rate of 13%.

Start from the MAIN menu.

Keys:	Display:	Description:
FIN CFLO		Displays the CFLO menu.
CLEAR ALL YES		Clears the number list.
180000 +/− INPUT		Stores the initial cash flow.
0 INPUT 5 INPUT		Stores 0 as first cash flow (store negative cash flows, skip positive cash flows).
100000 +/− INPUT 5 INPUT		Stores FLOW(2).
CALC		Displays the CALC menu.
8 ÷ 12 I%	I%=0.67	Stores monthly safe interest rate.
NPV	NPV=-654,136.81	Calculates NPV of negative cash flows.
STO 0		Stores NPV in register 0.

EXIT		Displays the CFLO menu.
CLEAR ALL YES		Clears the number list.
0 INPUT		Stores 0 as initial cash flow.
100000 INPUT 5 INPUT		Stores FLOW(1).
0 INPUT 5 INPUT		Stores 0 as FLOW(2).
0 INPUT 9 INPUT		Stores 0 as FLOW(3).
200000 INPUT INPUT		Stores FLOW(4).
CALC		Displays the CALC menu.
13 ÷ 12 I%	I%=1.08	Stores monthly reinvestment rate.
NFV	NFV=800,582.75	Calculates NFV of positive cash flows.
STO 1		Stores NFV in register 1.
MAIN FIN TVM		Displays the TVM menu.
CLEAR ALL OTHER CLEAR ALL EXIT		Clears TVM variables, sets 12 payments per year, and End mode.
20 N	N=20.00	Stores total number of months of investment.
RCL 0 PV	PV=-654,136.81	Stores present value of negative cash flows.
RCL 1 FV	FV=800,582.75	Stores future value of positive cash flows.
I%YR	I%YR=12.18	Calculates annual MIRR.

Example 2. An investor is considering the investment summarized below. His safe rate is 9% and he expects to reinvest positive cash flows at 14%. What is the MIRR?

Year	Cash Flow ($)
0	−75,000
1	− 9,500
2	27,000
3	−11,000
4	50,000
5	83,000

Start from the MAIN menu.

Keys:	Display:	Description:
FIN CFLO		Displays the CFLO menu.
CLEAR ALL YES		Clears the number list.
75000 +/− INPUT		Stores the initial cash flow.
9500 +/− INPUT INPUT		Stores FLOW(1).
0 INPUT INPUT		Stores 0 as FLOW(2).
11000 +/− INPUT INPUT		Stores FLOW(3).
CALC		Displays the CALC menu.
9 I%	I%=9.00	Stores safe interest rate.
NPV	NPV=-92,209.61	Calculates NPV of negative cash flows.

STO 0		Stores NPV in register 0.
EXIT		Displays the CFLO menu.
CLEAR ALL YES		Clears the number list.
0 INPUT		Stores 0 as initial cash flow.
0 INPUT INPUT		Stores 0 as FLOW(1).
27000 INPUT INPUT		Stores FLOW(2).
0 INPUT INPUT		Stores 0 as FLOW(3).
50000 INPUT INPUT		Stores FLOW(4).
83000 INPUT INPUT		Stores FLOW(5).
CALC		Displays the CALC menu.
14 I%	I%=14.00	Stores reinvestment rate.
NFV	NFV=180,001.69	Calculates NFV of positive cash flows.
STO 1		Stores NFV in register 1.
MAIN FIN TVM		Displays the TVM menu.
CLEAR ALL OTHER 1 #P/Y END EXIT		Clears TVM variables, sets 1 payment per year, and End mode.
5 N	N=5.00	Stores number of years in investment.
RCL 0 PV	PV=-92,209.61	Stores present value of negative cash flows.

RCL 1 FV	FV=180,001.69	Stores future value of positive cash flows.
I%YR	I%YR=14.31	Calculates annual MIRR.

A

Formulas Used

Graduated Payment Mortgages

$$GPMT = PV \div \left\{ \left[\frac{1 - (1 + I/1200)^{-12}}{I/1200} \right] \left[\frac{\left(\frac{1 + \%I/100}{(1 + I/1200)^{12}} \right)^{\#YR} - 1}{\frac{1 + \%I/100}{(1 + I/1200)^{12}} - 1} \right] + \frac{(1 + \%I/100)^{\#YR} \left[\frac{1 - (1 + I/1200)^{-[N - (12 \times \#YR)]}}{I/1200} \right]}{(1 + I/1200)^{12 \times \#YR}} \right\}$$

where:

PV = loan amount
$\%I$ = percentage increase in monthly payment
I = annual interest rate (as a percent)
$\#YR$ = number of years that payments increase
N = total number of payments
$GPMT$ = monthly payment

Reference:

Greynolds, Aronofsky, and Frame, *Financial Analysis Using Calculators*, McGraw-Hill Book Company, 1980.

Wrap-Around Loans

$$WRAP - \frac{WPMT\left[1 - \left(1 + \frac{YLD}{1200}\right)^{-(W\#N)}\right]}{\frac{YLD}{1200}} - WBAL\left(1 + \frac{YLD}{1200}\right)^{-(W\#N)} =$$

$$UNDER - \frac{UPMT\left[1 - \left(1 + \frac{YLD}{1200}\right)^{-(U\#N)}\right]}{\frac{YLD}{1200}} - UBAL\left(1 + \frac{YLD}{1200}\right)^{-(U\#N)}$$

where:
$WRAP$ = total amount of wrap-around loan
$WPMT$ = wrap-around loan monthly payment
YLD = annual yield to lender (as a percent)
$W\#N$ = number of monthly payments in wrap-around loan
$WBAL$ = wrap-around loan balloon payment
$UNDER$ = remaining balance of underlying loan
$UPMT$ = underlying loan monthly payment
$U\#N$ = number of monthly payments in underlying loan
$UBAL$ = underlying loan balloon payment

Canadian Mortgages

$$PV = -PMT\left[\frac{1 - (1 + r)^{-N}}{r}\right] - FV\,(1 + r)^{-N}$$

where: $r = \left[\left(1 + \frac{CI\%YR}{200}\right)^{1/6} - 1\right]$

N = total number of monthly payments
$CI\%YR$ = annual interest rate (as a percent)
PV = loan amount
PMT = monthly payment
FV = balloon payment

Modified Internal Rate of Return

$$MIRR = 100 \left[\left(\frac{NFV_P}{-NPV_N} \right)^{1/n} - 1 \right]$$

where:
n = total number of compounding periods
NFV_P = net future value of positive cash flows
NPV_N = net present value of negative cash flows

B

Conserving Memory

The formulas in this book are intended to provide useful solutions. The variable names are several characters long to be meaningful to you. The formulas change a percent to a decimal so you don't have to remember to do it. These features make the formulas longer and take up more memory. Here are a few hints to help you conserve memory, should you need to:

- Shorten variable names. Variables are named to be as intuitive as possible. One way to save memory is to use single letter variable names.
- Delete division by 100. The formulas using a percent are written so you enter the percentage rather than the decimal value. Examples of this are tax rate as a percent, discount rate as a percent, or interest rate. If you do delete division by 100 from the formulas, remember to divide the percent by 100, or key in the percent and press [%], before storing the value in the variable.
- Delete variables for other formulas. When the SOLVE menu is displayed and you press [CLEAR ALL] VARS, the variables are erased, giving you more usable memory. (If you select BOTH instead of VARS, all formulas and their variables are deleted.)
- Delete individual formulas. When the SOLVE menu is displayed, move the pointer to the formula you want to delete, and press DELET BOTH.

Working With Your Business Consultant Professional Calculator

The *Real Estate Consultant* contains a variety of applications, formulas and keystrokes to help you solve the specialized problems of your profession.

- Basic Mortgage Components
- Price to Pay for a Mortgage
- Yield of a Mortgage Traded at a Discount or Premium
- APR of a Loan With Fees
- Mortgage Measure Calculations
- Adjustable Rate Mortgages
- Graduated Payment Mortgages
- Amortization Schedules With Unequal Payments
- Wrap-Around Loans
- Biweekly Mortgage Payments
- Canadian Mortgages
- Modified Internal Rate of Return

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