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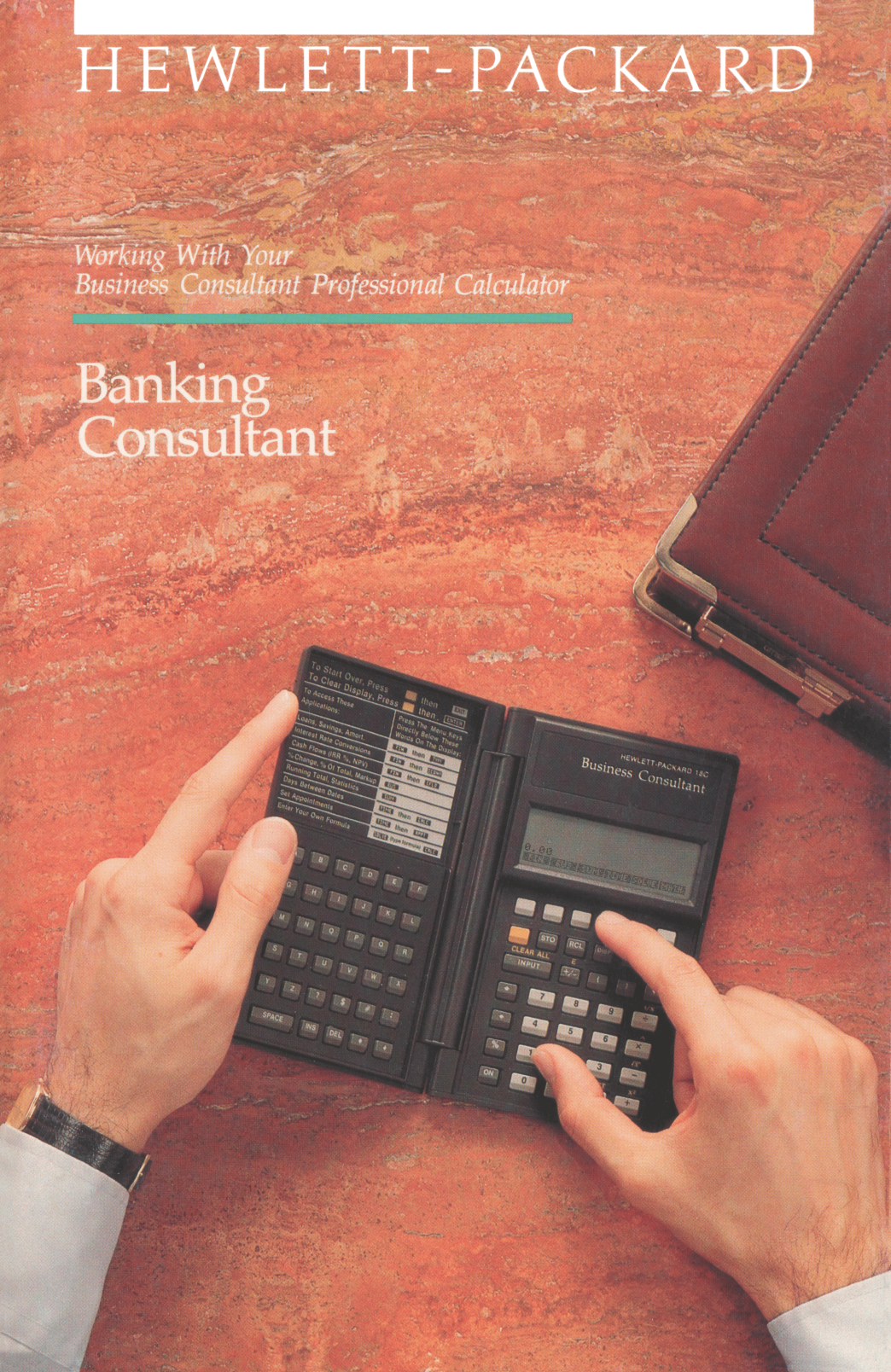
Working With Your
Business Consultant Professional Calculator

Banking Consultant



Banking Consultant

Business Consultant
Professional Calculator

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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 *Banking Consultant* is to provide a set of keystrokes and routines to assist you in analyzing lending and savings transactions. A variety of savings plans are described, as well as mortgage evaluation and consumer financing alternatives. The *Banking Consultant* is designed to serve as a reference to many of your banking needs, 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 *Banking 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 *Banking 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.

Savings Plans

These examples are presented as guidelines for evaluating savings plans when the payment period coincides with the compounding period.* Since the Time Value of Money (TVM) menu is used, remember the cash flow sign convention when entering dollar amounts (money paid out is entered as a negative number, money received is entered as a positive number).

Information is entered into the TVM menu as follows:

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 either Begin or End mode (as appropriate).
3. Store values in at least three of the following variables. (Both N and I%YR must be a part of a problem. Either both values are known, or one is known and the other is to be computed.)
   - Number of periodic deposits in N.
   - Annual interest rate in I%YR.
   - Initial investment in PV.
   - Periodic deposit in PMT.
   - Future value in FV.
4. Press the menu key of the unknown variable to calculate its value.

* If the periodic deposits do not coincide with the compounding periods, the account must be evaluated in another manner. Use the Compounding Periods Different From Payment Periods procedure on page 18.

Example 1: Balance of a Savings Account After Initial Deposit and Regular Deposits. You have just opened a savings account with a $200 deposit. If you deposit $50 a month, and the account earns 5¼% compounded monthly, how much will you have in the account in 3 years?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears the TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
3 × 12 N	N=36.00	Stores known values.
5.25 I%YR	I%YR=5.25	
200 +/- PV	PV=-200.00	
50 +/- PMT	PMT=-50.00	
FV	FV=2,178.94	Calculates amount in savings account in 3 years.

Example 2: Number of Deposits or Withdrawals to Reach a Specified Balance. Part 1. Your savings account presently contains $18,000 and earns 5¼% compounded monthly. You wish to withdraw $300 a month until the account is depleted. How long will this take?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears the TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
5.25 I%YR 18000 +/-	I%YR=5.25	Stores known values.
PV	PV=-18,000.00	
300 PMT	PMT=300.00	
N	N=69.75	Calculates number of months. (The 70th withdrawal will be less than $300.)

Part 2. If you wish to reduce the account to $5,000, how many withdrawals can you make?

5000 FV	FV=5,000.00	Stores remaining balance.
N	N=52.41	Calculates number of monthly withdrawals. (The 53rd withdrawal reduces the account balance to less than $5,000.)

Example 3: Amount to Deposit Today to Have a Certain Future Balance. How much money would you have to invest today if you want $10,000 in 10 years? Assume the interest rate is 9%, compounded annually.

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL		Clears the TVM variables.
OTHER 1 #P/Y END EXIT		Sets 1 payment per year; End mode.
10000 FV	FV=10,000.00	Stores known values.
9 I%YR	I%YR=9.00	
10 N	N=10.00	
PV	PV=-4,224.11	Calculates the amount to deposit today to have $10,000 in the future.

Example 4: Monthly Deposits to Reach a Future Balance. You plan to replace your car in 3 years, and you want to have $6,000 to help pay for the new one. How much should you save each month, beginning today, to accumulate $6,000 in 3 years? Assume 7.5% interest, compounded monthly.

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL		Clears the TVM variables.
OTHER CLEAR ALL BEG EXIT		Sets 12 payments per year; Begin mode.
3 × 12 N	N=36.00	Stores known values.
7.5 I%YR	I%YR=7.50	
6000 FV	FV=6,000.00	
PMT	PMT=-148.21	Calculates the monthly payment.

Example 5: Periodic Deposits and Withdrawals. Part 1. You are presently depositing $50 at the end of each month into a local savings and loan, earning 5¼% compounded monthly. Your account balance is $1,023.25. How much will you accumulate in 5 months?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL	0.00	Clears the TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
5 N	N=5.00	Stores known values.
5.25 I%YR	I%YR=5.25	
1023.25 +/-		
PV	PV=-1,023.25	
50 +/- PMT	PMT=-50.00	
FV	FV=1,298.03	Calculates account balance after five months.

Part 2. At the beginning of the sixth month, you withdraw $80. What is the new balance?

- 80 =	1,218.03	Calculates new balance.

Part 3. At the end of months six, seven and eight, you deposit $65. How much will you have in the account at the end of month eight?

+/- PV	PV=-1,218.03	Stores the beginning balance.
65 +/- PMT	PMT=-65.00	Stores known values.
3 N	N=3.00	
FV	FV=1,429.94	Calculates balance after an additional three months.

Part 4. You decide not to make deposits for the next two months. What is the balance in the account after those two months?

+/− PV	PV=-1,429.94	Stores the beginning balance.
2 N	N=2.00	Stores known values.
0 PMT	PMT=0.00	
FV	FV=1,442.48	Calculates balance after an additional two months.

This procedure can be continued for any length of time, and can be modified to meet your needs.

Savings Account Compounded Daily

The formula below determines the value of a savings account when interest is compounded daily. You can calculate the total amount in the account after a series of transactions on specified dates.

Entering and Using the SAVFV Formula:

1. From the MAIN menu, press SOLVE to display the SOLVE menu.
2. Enter the SAVFV formula as follows:

   ```
   SAVFV=(PV+PMT)×SPFV(I%YR÷365:
   DDAYS(DATE1:DATE2:1))
   ```

3. Press CALC to verify the formula and display the custom menu.
4. Store five of the following variables:
   - Value of the account on the second date in SAVFV.
   - Value of the account on the first date in PV.
   - Payment to the account in PMT.
   - Annual interest rate as a percent in I%YR.
   - First date in DATE1.
   - Second date in DATE2.
5. Press the menu key to calculate the unknown value.

Example. An account earns 5.25%, compounded daily. Calculate the amount in this account after the following transactions:

1. January 19, 1987 deposit $125.00.
2. February 24, 1987 deposit $60.00.
3. March 16, 1987 deposit $70.00.
4. April 6, 1987 withdraw $50.00.
5. June 1, 1987 deposit $175.00.
6. July 6, 1987 withdraw $100.00.

Start from the SAVFV menu.

Keys:	Display:	Description:
125 PV	PV=125.00	Stores the amount deposited on the first date.
0 PMT	PMT=0.00	Stores 0 as the payment amount.
5.25 I%YR	I%YR=5.25	Stores the nominal annual interest rate.
1.191987 DATE1	DATE1=1.19	Stores the first date.
2.241987 DATE2	DATE2=2.24	Stores the second date.
SAVFV	SAVFV=125.65	Calculates the value of the account on the second date.
STO PV	PV=125.65	Stores the balance of the savings account.
60 PMT	PMT=60.00	Stores amount of deposit.
RCL DATE2 STO DATE1	DATE1=2.24	Stores DATE2 as the first date.
3.161987 DATE2	DATE2=3.16	Stores the second date.
SAVFV	SAVFV=186.18	Calculates the value of the account on the second date.
STO PV	PV=186.18	Stores the balance of the savings account.
70 PMT	PMT=70.00	Stores amount of deposit.
RCL DATE2 STO DATE1	DATE1=3.16	Stores DATE2 as the first date.
4.061987 DATE2	DATE2=4.06	Stores the second date.
SAVFV	SAVFV=256.96	Calculates the value of the account on the second date.

STO PV	PV=256.96	Stores the balance of the savings account.
50 +/- PMT	PMT=-50.00	Stores amount of withdrawal.
RCL DATE2 STO DATE1	DATE1=4.06	Stores DATE2 as the first date.
6.011987 DATE2	DATE2=6.01	Stores the second date.
SAVFV	SAVFV=208.63	Calculates the value of the account on the second date.
STO PV	PV=208.63	Stores the balance of the savings account.
175 PMT	PMT=175.00	Stores amount of deposit.
RCL DATE2 STO DATE1	DATE1=6.01	Stores DATE2 as the first date.
7.061987 DATE2	DATE2=7.06	Stores the second date.
SAVFV	SAVFV=385.57	Calculates the value of the account on the second date.
- 100 =	285.57	Final amount in the savings account.

Compounding Periods Different From Payment Periods

Savings account deposits and withdrawals may not occur at the same time as the bank's compounding periods. The TVM menu, however, assumes these two periods are the same. This procedure shows you how to adjust the interest rate so that you can use the TVM menu in situations when the compounding period is different from the payment period.

When the bank's interest rate is known, adjust the annual interest rate to correspond to the payment period, then use the TVM menu to calculate the unknown value.

1. From the MAIN menu, press FIN ICONV EFFCT to display the effective interest rate conversion menu.
2. Store the following variables. The bank provides this information.
   - Nominal annual interest rate in NOM%.
   - Number of compounding periods per year in P.
3. Press EFF% to calculate the effective annual interest rate.
4. Store the number of payments or withdrawals per year in P.
5. Press NOM% to calculate the nominal rate that corresponds to the payment period.
6. Press ■ MAIN FIN TVM to display the TVM menu.
7. Press STO I%YR to store the adjusted nominal rate.
8. Store the number of payments per year in #P/Y and set either Begin or End mode (as appropriate).
9. Store or calculate the following variables. Remember to use the cash flow sign convention (money paid out is negative; money received is positive).
   - Total number of periodic deposits in N.
   - Initial deposit in PV.
   - Amount of periodic deposit or withdrawal in PMT.
   - Future value in FV.

When the interest rate is the unknown variable, calculate I%YR in the TVM menu (this is the nominal rate that corresponds to the payment period). Then use the ICONV menu to calculate the nominal annual interest rate.

Example 1: Balance of a Savings Account. Starting today, you make monthly deposits of $25 into an account paying 5% interest compounded daily (365-day basis). At the end of 7 years, how much will you receive from the account?

Start from the MAIN menu.

Keys:	**Display:**	**Description:**
FIN ICONV EFFCT		Displays the EFFCT menu.
5 NOM% 365 P	NOM%=5.00 P=365.00	Stores the known values.
EFF%	EFF%=5.13	Calculates the effective interest rate for daily compounding.
12 P	P=12.00	Stores the number of deposits per year.
NOM%	NOM%=5.01*	Calculates the equivalent nominal interest rate for monthly compounding.
EXIT EXIT TVM		Displays the TVM menu.
STO I%YR	I%YR=5.01	Stores the interest rate.
OTHER 12 #P/Y BEG EXIT		Sets 12 payments per year; Begin mode.

* Because compounding is less frequent, a higher nominal interest rate is needed to achieve the same effective rate.

7 [×] 12 [N] 25 [+/-] [PMT] 0 [PV]	N=84.00 PMT=-25.00 PV=0.00	Stores the known values.
[FV]	FV=2,519.61	Calculates the value of the account in seven years.

Example 2: Amount to Deposit Today to Have a Certain Future Balance. You wish to make weekly deposits for eight years into a savings account paying 5¼% interest compounded quarterly. How much should you deposit each week to accumulate $6,000?

Start from the MAIN menu.

Keys:	**Display:**	**Description:**
[FIN] [ICONV] [EFFCT]		Displays the EFFCT menu.
5.25 [NOM%] 4 [P]	NOM%=5.25 P=4.00	Stores the known values.
[EFF%]	EFF%=5.35	Calculates the effective rate for quarterly compounding.
52 [P]	P=52.00	Stores the number of deposits per year.
[NOM%]	NOM%=5.22	Calculates the equivalent nominal interest rate for weekly compounding.
[EXIT] [EXIT] [TVM]		Displays the TVM menu.
[STO] [I%YR]	I%YR=5.22	Stores the interest rate.
[OTHER] 52 [#P/Y] [BEG] [EXIT]		Sets 52 payments per year; Begin mode.
8 [×] 52 [N] 6000 [FV] 0 [PV]	N=416.00 FV=6,000.00 PV=0.00	Stores the known values.
[PMT]	PMT=-11.62	Calculates amount of weekly deposit.

Example 3: Length of Time to Accumulate a Balance. You make weekly deposits of $10 into an account paying 5¼% compounded daily (365-day basis). How long will it take to accumulate $1,000?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN ICONV EFFCT		Displays the EFFCT menu.
5.25 NOM% 365 P	NOM%=5.25 P=365.00	Stores the known values.
EFF%	EFF%=5.39	Calculates the effective rate for daily compounding.
52 P	P=52.00	Stores the number of deposits per year.
NOM%	NOM%=5.25*	Calculates the equivalent nominal interest rate for weekly compounding.
EXIT EXIT TVM		Displays the TVM menu.
STO I%YR	I%YR=5.25	Stores the interest rate.
OTHER 52 #P/Y BEG EXIT		Sets 52 payments per year; Begin mode.
10 +/- PMT 1000 FV 0 PV	PMT=-10.00 FV=1,000.00 PV=0.00	Stores the known values.
N	N=95.22	Calculates the number of weeks. (The 96th deposit places the balance over $1,000.)

* To see the difference between the two nominal rates, display more than two digits past the decimal point.

Example 4: Calculating Interest Rate. Your bank statement indicates that you earned $4.63 in interest for one month. Your beginning balance was $975.46. What interest rate is your bank quoting, assuming daily compounding on a 365-day basis?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN TVM		Displays the TVM menu.
CLEAR ALL		Clears the TVM variables.
OTHER 12 #P/Y BEG EXIT		Sets 12 payments per year; Begin mode.
1 N 975.46 +/-	N=1.00	Stores the known values.
PV +/- + 4.63	PV=-975.46	
FV	FV=980.09	
I%YR	I%YR=5.70	Calculates the periodic interest rate.
EXIT ICONV EFFCT		Displays the EFFCT menu.
STO NOM%	NOM%=5.70	Stores the nominal interest rate.
12 P	P=12.00	Stores the number of deposits per year.
EFF%	EFF%=5.85	Calculates the effective rate for monthly compounding.
365 P	P=365.00	Stores the number of compounding periods per year.
NOM%	NOM%=5.68	Calculates the nominal interest rate quoted by the bank.

Increasing Annuities

These procedures calculate the present and future values of an annuity (a series of payments) that increases at a constant rate at equal intervals of time. The first formula (PVINCR), calculates the present value of an increasing annuity. Once the present value has been calculated, the second formula (FVINCR) calculates the future value of the annuity.

Entering and Using the PVINCR and FVINCR Formulas:

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

   ```
   PVINCR=PMT×USPV(I%YR÷P/YR:#PER)×
   USFV(((1+%INCR÷100)÷(1+I%YR÷P/YR÷100)^
   #PER-1)×100:#YRS×P/YR÷#PER)
   ```

3. Press INPUT to verify the formula.
4. Type in the FVINCR formula as follows.*

   ```
   FVINCR=SPFV(I%YR÷P/YR:#YRS×P/YR)×PVINCR
   ```

5. Press INPUT to verify the formula.
6. Press ↑ CALC to designate PVINCR as the current formula and display the custom menu.
7. Store the following variables:
   - Periodic payment amount in PMT.
   - Annual interest rate as a percent in I%YR.
   - Number of payments per year in P/YR.
   - Number of periods before payments increase in #PER.
   - Percentage of each increase in %INCR.
   - Total number of years in #YRS.
8. Press PVINC to calculate the present value of the increasing annuity.

* To key in the / character, press ■ W.

9. Press EXIT ↓ CALC to designate FVINCR as the current formula and display the custom menu.

10. Press FVINC to calculate the future value of the increasing annuity.

Example 1. A client has a 20-year annuity that pays $110 per month for the first year. The monthly payment increases 5.5% each year. Assuming a discount rate of 11.5%, what is the present value of the series of payments?

Start from the PVINCR custom menu.

Keys:	Display:	Description:
110 PMT	PMT=110.00	Stores known values.
11.5 I%YR	I%YR=11.50	
12 P/YR	P/YR=12.00	
12 #PER	#PER=12.00	
MORE		Displays second set of menu labels.
5.5 %INCR	%INCR=5.50	Stores known values.
20 #YRS	#YRS=20.00	
MORE		Displays first set of menu labels.
PVINC	PVINCR=14,793.46	Calculates present value of increasing annuity.

Example 2. Starting at the end of this year, you plan to make yearly deposits into an account that earns 13% interest, compounded annually. Each year you plan to increase the amount of your deposit by 8%. If the first deposit is $1,200, how much will you accumulate over the next 10 years?

Start from the PVINCR custom menu.

Keys:	Display:	Description:
1200 PMT	PMT=1,200.00	Stores known values.
13 I%YR	I%YR=13.00	
1 P/YR	P/YR=1.00	
1 #PER	#PER=1.00	
MORE		Displays second set of menu labels.
8 %INCR	%INCR=8.00	Stores known values.
10 #YRS	#YRS=10.00	
MORE		Displays first set of menu labels.
PVINC	PVINCR=8,736.14	Calculates present value of increasing annuity.
EXIT ↓ CALC		Moves the list pointer to the FVINCR formula.
FVINC	FVINCR=29,655.42	Calculates the future value of the increasing annuity.

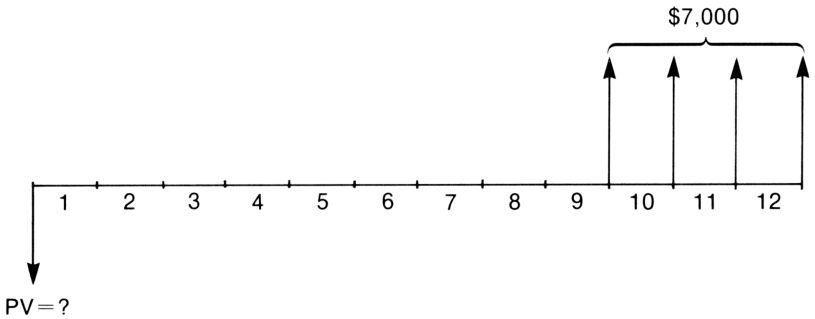
This example assumes that PVINCR is calculated immediately before FVINCR. If this is not the case, the calculation of FVINCR requires that values be stored in I%YR, P/YR, #YRS, and PVINC.

Deferred Annuities

Sometimes transactions are established where payments do not begin for a specified number of periods; the payments are deferred. To calculate the present value of a deferred annuity, use the NPV function, storing $0 as the amount of the initial cash flow and $0 as the amount for all periods where there is no cash flow.

Example 1. You have just inherited $20,000 and wish to put some of it aside for your daughter's college education. You estimate that when she is of college age, nine years from now, she will need $7,000 at the beginning of each year for four years to cover college tuition and expenses. You wish to establish a fund that earns 6% annually. How much do you need to deposit in the fund today to meet your daughter's educational expenses?

The cash flow diagram looks like this:



Start from the MAIN menu.

Keys:	Display:	Description:
FIN CFLO		Displays the CFLO menu.
CLEAR ALL YES	0.00	Clears the CFLO list.
0 INPUT		Stores initial cash flow.
0 INPUT 8 INPUT		Stores first through eighth cash flows.
7000 INPUT 4 INPUT		Stores ninth through twelfth cash flows.
CALC		Displays the CALC menu.
6 I%	I%=6.00	Stores annual interest rate.
NPV	NPV=15,218.35	Calculates amount of deposit needed for college fund.

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 $2,000. 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 − 150 PV	PV=59,850.00	Stores actual amount 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.

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.

Odd-Period Calculations

The TVM menu deals with financial transactions in which each payment period is the same length. However, situations exist in which the first payment period is not the same length as the remaining periods. The period from the date that interest begins accruing to the date of the first payment, when not equal to the regular payment period, is sometimes referred to as an *odd first period.*

The following procedure calculates N, I%, PV, PMT, or FV for transactions involving an odd first period. Simple interest accrues during the odd period. The formula is valid for 0 to 59 days, and a 30-day month is assumed.*

Entering and Using the ODD Formula:

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

```
ODD:PV×(I%÷100×FP(DAYS÷30)+1)=
-IF(DAYS<30:(1+I%÷100)×PMT:PMT)×
USPV(I%:N)-FV×SPPV(I%:N)
```

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

* This procedure duplicates the odd-period calculations (using simple interest) of the HP-12C, with one difference. You do not need to specify Begin or End mode. If the number of days until the first payment is less than 30, Begin mode is assumed. If the number of days until the first payment is between 30 and 59, inclusive, End mode is assumed.

† To key in the < character, press ■ Y.

4. Store or calculate the following variables. Remember to use the cash flow sign convention (money paid out is negative, money received is positive).
   - Loan amount in PV.
   - Periodic interest rate as a percent in I%.
   - Actual number of days until the first payment is made in DAYS.
   - Periodic payment amount in PMT.
   - Total number of payments in N.
   - Balloon payment amount in FV. (The balloon payment occurs at the end of the Nth period and is in addition to any periodic payment.)

Example 1. A 36-month loan for $4,500 has an interest rate of 15%. If the first payment is made in 46 days, what is the monthly payment amount?

Start from the ODD menu.

Keys:	Display:	Description:
36 N	N=36.00	Stores known values.
4500 PV	PV=4,500.00	
15 ÷ 12 I%	I%=1.25	
46 DAYS	DAYS=46.00	
0 FV	FV=0.00	
PMT	PMT=-157.03*	Calculates monthly payment amount.

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

Example 2. A $10,000 loan has 24 monthly payments of $400, plus a balloon payment of $3,000 at the end of the 24th month. If the payments begin in 8 days, what interest rate is being charged?

Start from the ODD menu.

Keys:	Display:	Description:
10000 PV	PV=10,000.00	Stores known values.
24 N	N=24.00	
400 +/- PMT	PMT=-400.00	
3000 +/- FV	FV=-3,000.00	
8 DAYS	DAYS=8.00	
I%	I%=1.64*	Calculates monthly interest rate.
× 12 =	19.67	Calculates annual interest rate.

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

Advance Payments

Situations may exist where one or more payments are made in advance (leasing is a good example). These agreements call for the extra payments to be made when the transaction is closed. A residual value (salvage value) can exist at the end of the normal term.

The following formula calculates the monthly payment amount (PMT) and the annual yield (I%YR) when one or more payments are made in advance. The formula can be modified to accommodate other than monthly payments by changing the constant 12 to the number of payments per year. In that case, PMT, N, and #ADV would apply to the periodic payment. Remember to use the cash flow sign convention (money paid out is negative, money received is positive).

Entering and Using the ADVPMT Formula:

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

   ```
   ADVPMT:PMT=(-PV-FV×(SPPV(I%YR÷12:N)))÷
   (USPV(I%YR÷12:N-#ADV)+#ADV)
   ```

3. Press CALC to verify the formula and to display the custom menu.
4. Store or calculate the following variables:
   - Monthly payment amount in PMT.
   - Loan amount in PV.
   - Amount of the balloon payment in FV.
   - Annual interest rate as a percent in I%YR.
   - Total number of monthly payments in N.
   - Number of monthly payments made in advance in #ADV.

Example 1. Equipment worth $750 is leased for 12 months. The equipment is assumed to have no salvage value at the end of the lease. The lessee has agreed to make three payments at the time of closing. What monthly payment is necessary to yield the lessor 10% annually?

Start from the ADVPMT custom menu.

Keys:	Display:	Description:
750 [+/-] PV	PV=-750.00	Stores known values.
12 N	N=12.00	
0 FV	FV=0.00	
3 #ADV	#ADV=3.00	
10 I%YR	I%YR=10.00	
PMT	PMT=64.45	Calculates monthly payment.

Example 2. Continuing from example 1, what is the payment amount if the yearly interest rate is 15%?

Keys:	Display:	Description:
15 I%YR	I%YR=15.00	Stores new interest rate.
PMT	PMT=65.43	Calculates monthly payment to achieve 15% yield.

Example 3. A lease has been written to run for 60 months. The leased equipment has a value of $25,000 and a monthly payment of $600. The lessee has agreed to make 3 payments at the time of closing ($1,800). What is the annual yield to the lessor?

Start from the ADVPMT custom menu.

Keys:	Display:	Description:
60 N	N=60.00	Stores known values.
3 #ADV	#ADV=3.00	
600 PMT	PMT=600.00	
25000 +/-		
PV	PV=-25,000.00	
0 FV	FV=0.00	
I%YR	I%YR=17.33*	Calculates percent annual yield.

Example 4. Equipment worth $5,000 is leased for 36 months at $145 per month. The lessee has agreed to pay the first and last payments in advance. At the end of the lease, the equipment can be purchased for $1,500. What is the annual yield to the lessor if the equipment is purchased?

Start from the ADVPMT custom menu.

Keys:	Display:	Description:
5000 +/- PV	PV=-5,000.00	Stores known values.
36 N	N=36.00	
145 PMT	PMT=145.00	
2 #ADV	#ADV=2.00	
1500 FV	FV=1,500.00	
I%YR	I%YR=18.10*	Calculates annual yield to lessor.

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

Loan With a Constant Amount Paid Towards Principal

This type of loan is structured so that the principal is repaid in equal installments, with the interest paid in addition. Therefore, each periodic payment has a constant amount applied toward the principal and a varying amount of interest.

The following formulas compute the amount of each periodic payment and the remaining balance.

Entering and Using the CNSTPMT and CNSTBAL Formulas:

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

   `CNSTPMT:TPMT=CPMT+I%÷100×(PV-(PMT#-1)×CPMT)`
3. Press INPUT to verify the formula.
4. Type in the CNSTBAL formula as follows.

   `CNSTBAL:BAL=PV-PMT#×CPMT`
5. Press INPUT to verify the formula.
6. Press ↑ CALC to designate CNSTPMT as the current formula and display the custom menu.
7. Store the following variables:
   - Amount of constant payment to principal in CPMT.
   - Periodic interest rate as a percent in I%.
   - Loan amount in PV.
   - Payment number in PMT#.
8. Press TPMT to calculate the total amount of the payment (principal plus interest).
9. Press EXIT ↓ CALC to designate CNSTBAL as the current formula and display the custom menu.
10. Store the payment number in PMT#.
11. Press BAL to calculate the balance remaining after the specified payment is made.

Example. A $60,000 loan at 10% has equal semi-annual principal payments of $5,000 for six years. What is the amount of each payment in year 1? What is the balance after the 8th payment?

Start from the CNSTPMT custom menu.

Keys:	Display:	Description:
5000 CPMT	CPMT=5,000.00	Stores known values.
10 ÷ 2 I%	I%=5.00	
60000 PV	PV=60,000.00	
1 PMT#	PMT#=1.00	
TPMT	TPMT=8,000.00	Calculates total first payment.
2 PMT#	PMT#=2.00	Stores payment number.
TPMT	TPMT=7,750.00	Calculates total second payment.
EXIT ↓ CALC		Displays CNSTBAL custom menu.
8 PMT#	PMT#=8.00	Stores payment number.
BAL	BAL=20,000.00	Calculates balance after 8th payment.

Rule of 78's Interest Rebate

This procedure calculates the unearned interest rebate, as well as the remaining principal balance due for a prepaid consumer loan using the Rule of 78's. The known values are the current installment number, the total number of installments for which the loan was written, and the total finance charge (amount of interest).

Entering and Using the REBATE and BAL Formulas:

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

   ```
   RBATE=(#MO-PMT#)×(2×(#MO-PMT#+1)÷
   (#MO×(#MO+1))×FCHG)÷2
   ```

3. Press INPUT to verify the formula.
4. Type in the BAL formula as follows.

   ```
   BAL=(#MO-PMT#)×PMT-RBATE
   ```

5. Press INPUT to verify the formula.
6. Press ↑ CALC to designate RBATE as the current formula and display the custom menu.
7. Store the following variables:
   - Total number of months in loan in #MO.
   - Payment number when prepayment occurs in PMT#.
   - Total finance charge in FCHG.
8. Press RBATE to calculate the rebate amount (the amount of unearned interest).
9. Press EXIT ↓ CALC to designate BAL as the current formula and display the custom menu.
10. Store the amount of the monthly payment in PMT.
11. Press BAL to calculate the remaining balance.

Example. A 48 month, $8,500 loan having a finance charge of $160 is being repaid at $226.66 per month. Calculate the rebate and balance due after the 35th regular payment.

Start from the RBATE custom menu.

Keys:	Display:	Description:
48 #MO	#MO=48.00	Stores known values.
35 PMT#	PMT#=35.00	
160 FCHG	FCHG=160.00	
RBATE	RBATE=12.38	Calculates the unearned interest (rebate).
EXIT ↓ CALC		Displays the BAL custom menu.
226.66 PMT	PMT=226.66	Stores monthly payment amount.
BAL	BAL=2,934.20	Calculates the remaining balance.

Add-On Interest Rates and APR

An add-on interest rate determines what portion of the principal will be added on for repayment of a loan. This sum is then divided by the number of months in the loan to determine the monthly payment. For example, a $6,000, 10% add-on rate for one year means that you add 10 percent of $6,000 on to the amount of the loan. This amount is usually called the "finance charge." The total loan amount is $6,600, and the monthly payment is $550.00 (6600 ÷ 12). If the loan is for two years, add a finance charge of $1,200 (600 × 2), giving a monthly payment of $300.00 (7200 ÷ 24).

The following formula converts an add-on interest rate (RATE) to an APR (I%YR), or converts an APR to an add-on rate. The formula can be modifed to accommodate other than monthly payments by changing the constant 12 to the number of payments per year. In that case, #MO would reflect the total number of payments.

Entering and Using the ADDON Formula:

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

   ```
   ADDON:#MO÷(1+(#MO÷12)×(RATE÷100))=
   USPV(I%YR÷12:#MO)
   ```

3. Press CALC to verify the formula and to display the custom menu.
4. Store or calculate the following variables:
   - Total number of months in the loan in #MO.
   - Add-on interest rate in RATE.
   - Annual interest rate (as a percent) in I%YR.

Example 1. Calculate the APR and monthly payment of a 9.5%, $15,000 add-on loan that has a term of 36 months.

Start from the ADDON custom menu.

Keys:	Display:	Description:

36 #MO
9.5 RATE
	#MO=36.00
	RATE=9.50
		Stores known values.

I%YR STO 0	I%YR=17.08*	Calculates APR and stores value in register 0.

Once the APR has been calculated, display the TVM menu to calculate the monthly payment:

Continue from the ADDON custom menu.

Keys:	Display:	Description:
MAIN FIN TVM	17.08	Displays the TVM menu.
CLEAR ALL		Clears TVM variables.
OTHER CLEAR ALL EXIT		Sets 12 payments per year; End mode.
RCL 0 I%YR 36 N 15000 PV	I%YR=17.08 N=36.00 PV=15,000.00	Stores known values.
PMT	PMT=-535.42	Calculates monthly payment.

Example 2. What is the equivalent add-on rate for a 24-month loan with an APR of 13.5%?

Since you are in the TVM menu (after completing Example 1), press MAIN and SOLVE to display the SOLVE menu. The list pointer should be pointing to the ADDON formula.

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

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

Start from the ADDON custom menu.

Keys:	Display:	Description:
24 #MO	#MO=24.00	Stores known values.
13.5 I%YR	I%YR=13.50	
RATE	RATE=7.33	Calculates add-on rate.

Skipped Payments

Sometimes a loan (or lease) can be negotiated in which a specific number of monthly payments are going to be skipped each year. Seasonality is usually the reason for such an agreement. For example, because of heavy rainfall, a bulldozer cannot be operated in Oregon during December, January, and February, and the lessee wishes to make payments only when his machinery is being used. He makes nine payments per year, but the interest continues to compound during the months in which a payment is not made.

The following procedure calculates the monthly payment amount necessary to amortize the loan in the specified amount of time. The only restriction is that the term of the loan must be an integer number of years.

1. From the MAIN menu, press FIN, then CFLO to display the cash flow menu.
2. Using a cash flow of $1.00 for each payment that is made during the first 12 months, and $0 for each payment that is skipped, calculate the NFV, at the discount rate, of the cash flows in year 1. (This is an equivalent annual cash flow that occurs at the end of the first year.) Store the result in register 0.
3. Display the interest conversion menu (ICONV) and calculate the effective annual interest rate.
4. Display the TVM menu, store the effective interest rate in I%YR, store 1 in #P/Y, and set End mode.
5. Store the total number of years in N, the value from register 0 in PMT, and 0 in FV.
6. Press PV to calculate the present value of the annualized payments.
7. Key in the loan amount and press ÷ RCL PV = to calculate the monthly payment amount.

Reference:

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

Example. A bulldozer worth $100,000 is purchased in September. The first payment is due one month later, and payments continue for 5 years. Because of the weather, the machinery will not be used during the winter months, and the purchaser does not wish to make payments during January, February, and March (months 4 thru 6). If the current interest rate is 14%, what monthly payment is necessary to amortize the loan?

Start from the MAIN menu.

Keys:	Display:	Description:
FIN CFLO *		Displays the CFLO menu.
CLEAR ALL		Clears the list.
YES	0.00	
0 INPUT		Stores 0 as initial cash flow.
1 INPUT 3 INPUT		Stores first group of cash flows.
0 INPUT 3 INPUT		Stores second group of cash flows.
1 INPUT 6 INPUT		Stores third group of cash flows.
CALC		Displays CALC menu.
14 ÷ 12 I%	I%=1.17	Stores monthly discount rate.
NFV	NFV=9.55	Calculates net future value of cash flows in first year.
STO 0		Stores NFV in register 0.
EXIT EXIT ICONV		Displays ICONV menu.
EFFCT		Displays EFFCT menu.

* If you want to preserve the current list, skip the next step (pressing CLEAR ALL), name the list, then press GET *NEW.

14 NOM% 12 P	NOM%=14.00 P=12.00	Stores known values.
EFF%	EFF%=14.93	Calculates effective annual interest rate.
EXIT EXIT TVM		Displays TVM menu.
STO I%YR	I%YR=14.93	Stores annual interest rate.
OTHER 1 #P/Y END EXIT		Stores 1 payment per year and sets End mode.
5 N RCL 0 PMT 0 FV	N=5.00 PMT=9.55 FV=0.00	Stores known values.
PV	PV=-32.05	Calculates present value of $1 cash flows.
100000 ÷ RCL PV =	-3,119.89	Calculates monthly payment amount.

A

Formulas Used

Increasing Annuities

$$PVINCR = PMT \left[\frac{1 - \left(1 + \frac{I\%YR}{100 \times P/YR}\right)^{-P/YR}}{\frac{I\%YR}{100 \times P/YR}} \right] \times \left[\frac{\left(\frac{1 + \frac{\%INCR}{100}}{\left[1 + \left(\frac{I\%YR}{P/YR \times 100}\right)\right]^{\#PER}} \right)^{\frac{\#YRS \times P/YR}{\#PER}} - 1}{\frac{1 + \frac{\%INCR}{100}}{\left[1 + \left(\frac{I\%YR}{P/YR \times 100}\right)\right]^{\#PER}} - 1} \right]$$

$$FVINCR = PVINCR \left(1 + \frac{I\%YR}{100 \times P/YR}\right)^{\#YRS \times P/YR}$$

where: $PVINCR$ = present value of increasing annuity
PMT = periodic payment amount
$I\%YR$ = annual interest rate (as a percent)
P/YR = number of payments per year
$\#PER$ = number of periods at a given interest rate
$\%INCR$ = percentage increase in payment
$\#YRS$ = total number of years
$FVINCR$ = future value of increasing annuity

Odd-Period Calculations

$$PV\left[1 + i \times \frac{DAYS}{30}\right] = -(1 + i \times S) \times PMT \times \left[\frac{1 - (1 + i)^{-N}}{i}\right] - FV(1 + i)^{-N}$$

where:
PV = loan amount
i = periodic interest rate as a decimal
$DAYS$ = actual number of days until the first payment
PMT = periodic payment amount
N = total number of payments
FV = balloon payment amount
$S = 1$ if $DAYS < 30$
$S = 0$ if $DAYS \geqslant 30$

Advance Payments

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

where:
PMT = payment amount
PV = loan amount
FV = balloon payment amount
i = periodic interest rate (as a decimal)
N = total number of payments
$\#ADV$ = number of payments made in advance

Loan With a Constant Amount Paid Towards Principal

$$TPMT = CPMT + \frac{I\%}{100}\,(PV - CPMT\,(PMT\# - 1))$$

$$BAL = PV - CPMT\,(PMT\#)$$

where: $TPMT$ = total payment amount
$CPMT$ = amount of constant payment to principal
$I\%$ = periodic interest rate as a percent
PV = loan amount
$PMT\#$ = payment number
BAL = balance remaining

Rule of 78's Interest Rebate

$$RBATE = (\#MO - PMT\#)\left(\frac{2\,(\#MO - PMT\# + 1)}{\#MO\,(\#MO + 1)}\right)\left(\frac{FCHG}{2}\right)$$

$$BAL = (\#MO - PMT\#)\,PMT - RBATE$$

where: $RBATE$ = rebate amount (unearned interest)
$\#MO$ = number of months
$PMT\#$ = payment number where prepayment occurs
$FCHG$ = total finance charge

Add-On Interest Rates and APR

$$\frac{\#MO}{\left(1 + \frac{\#MO}{12}\right)\left(\frac{RATE}{100}\right)} = \frac{1 - \left(1 + \frac{I\%YR}{1200}\right)^{\#MO}}{\frac{I\%YR}{1200}}$$

where: $\#MO$ = total number of months
$RATE$ = add-on rate as a percent
$I\%YR$ = APR (annual percentage rate)

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 enter 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. Move the pointer to the formula you want to delete, and press DELET BOTH.

Working With Your Business Consultant Professional Calculator

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

- Savings Plans
- Savings Accounts Compounded Daily
- Compounding Periods Different From Payment Periods
- Increasing Annuities
- Deferred Annuities
- Price to Pay for a Mortgage
- Yield of a Mortgage Traded at a Discount or Premium
- APR of a Loan With Fees
- Adjustable Rate Mortgages
- Odd-Period Calculations
- Advance Payments
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- Rule of 78's Interest Rebate
- Add-On Interest Rates and APR
- Skipped Payments

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