hp calculators

HP 17bII+ End-User Applications

We work problems in this module from a particular perspective. If you are a homebuyer/borrower, certain financial questions are likely to come up in the course of buying a home. That lender loaning the money looks at this loan transaction from a different viewpoint possibly. The real estate broker and the real estate appraiser have their important concerns. So do investors. We will look in this module at issues important to various users of financial data and how the HP 17bII+ can help in finding answers.

1. A homebuyer has found a home and needs a loan to complete the purchase. A
    local bank is offering the buyer a $250,000. loan at 6.75% annual interest,
    monthly payments over 30 years to fully amortize the loan. What is the buyer
    going to pay in loan repayments each month for this loan?

    Solution:

<u>From the main menu go to the TVM menu</u>

FIN
TVM

<u>Clear the menu</u>

SK (shift key)
CLR DATA

<u>Set the calculator to 12 payments per year</u>

OTHER
12
P/YR
EXIT

<u>Put in the information you do know:</u>

250000
PV
6.75
I%YR
30
SK
N

<u>Solve for what you don't know</u>

PMT   Answer: -1,621.50

Answer: The buyer will make payments of $1,621.50 every month to fully
         amortize (pay back) this loan over 30 years.

2. The homebuyer in problem #1 decides to increase the monthly payment every
    month by $100. in order to pay the loan off before 30 years is up. If the buyer
    makes this increased loan payment every month, how long will it take to pay off
    this loan?

    Solution: Keep all the information in the financial registers of your TVM menu.
               Change only the payment by putting the increased loan payment into
               'PMT.' Solve for 'N.'

<u>Keystrokes</u>

1721.50
+/-

Remember that the payment is negative.

PMT
N   Answer: 302.64

It would take 302 full payments and one partial one to pay off this loan.
303 payments divided by 12 months per year is 25 years and three
months. The buyer would save four years and nine months of payments.

3. The homebuyer in problems #1 and #2 had to pay three points as a loan fee to get
this loan. What is the annual percentage rate this buyer is actually paying and
the lender receiving?

Solution: Press in the same keystrokes that you had for problem #1 and solve for
the loan payment.

A point for a loan fee is 1% of the face amount of the loan. If the
borrower must pay three points, that means the loan fee is 3% of the
$250,000. What you want to do here is to reduce the loan amount by
this 3%, because that is what is net to the borrower. Use these keystrokes:

<u>Alg</u>

250000
-
3
%
=   Answer: 242,500.

<u>RPN</u>

250000
ENTER
3
%
-              Answer: 242,500.

You want to put this into 'PV' and re-solve for 'I%YR.' What you are doing
is asking the calculator to figure the real interest rate the borrower is paying
in light of the fact the borrower is actually getting only $242,500., not
$250,000., from the lender when forced to pay the three-point loan fee.

<u>Keystrokes</u>

242500
PV
I%YR   Answer: 7.05

The borrower's actual rate of interest, called the "annual percentage rate," is 7.05%. This is also the annual yield for the lender.

4. The homebuyer/borrower in problems #1 through #3 plans to keep the home for five years and wonders over this time how much of the loan payment will go for interest, how much will be applied to principal, and what the loan balance will be after those five years of payments.

Solution: Again, repeat the keystrokes in problem #1 to calculate the loan payments. Also set your display to two places to the right of the decimal with:

DSP
FIX
2
INPUT

The number of places to the right of the decimal influences slightly the amortization numbers you will calculate.

Then:

Go to the amortization menu

OTHER
AMRT

Key in the number of payments

60 (12 months per year for five years)
#P

Solve

INT Answer: -81,978.91
PRIN   Answer: -15,311.09
BAL   Answer: 234,688.91

5. A residential real estate agent is looking for a loan for a homebuyer who has informed the agent budget considerations require that the payment on the loan can be no more than $1,800. The financing available for the home in which the buyer is interested is at 7.50% over a term of 20 years with monthly payments fully amortizing the loan. What should the real estate agent do in order to calculate how much of a loan the buyer can get under these circumstances?

Solution: Use the TVM menu to calculate the loan amount.

<u>Keystrokes</u>

1800
+/-
PMT
7.5
I%YR
20
SK
N

You have told the calculator all the information you know. Solve, then, for the loan amount that can be paid back under these conditions:

PV   Answer: 223,437.84

The real estate agent can tell the buyer that the proposed loan payment with these loan terms could fully pay back a loan of $223,437.84.

6. A commercial real estate agent wants to calculate the internal rate of return for a client who is looking at a property that is projected to earn the following incomes:

Estimated cash flow at the end of period #1: ($5,000.)
periods #2 through #6: $30,000./period
period #7: $450,000.

Year #7 includes a reversionary value of $400,000. This is the amount for which the property is projected to sell.

The client is proposing to pay $210,000. for the property.

Solution:

<u>From the main menu go to the cash flow menu:</u>

FIN
CFLO

<u>Clear the cash flow menu:</u>

SK (shift key)
CLR DATA
YES

<u>Key in the cash flows</u>

210000
+/-
INPUT
5000
+/-
INPUT
INPUT
30000
INPUT
5
INPUT
450000
INPUT

<u>Go to the calculation menu</u>

EXIT
CALC

<u>Solve for the internal rate of return</u>

IRR%   Answer: 18.62

The real estate agent could advise the investor that the internal rate of return, the average periodic return on what the investor is proposing to pay for the property, is 18.62%.

7. A real estate agent receives a call from a good client who wants to know if the client's loan balance has been paid down enough so that the private mortgage insurance the lender has forced the client to carry can be dropped. The agent knows that the original loan was $175,000. for a term of 15 years, at 5.50% annual interest, with monthly payments fully amortizing the loan. The client has made three years of payments. The bank will drop its requirement for the private mortgage insurance when the outstanding balance of the loan reaches $150,000.

Solution: The agent should calculate the loan payment for the conditions under which the loan was made. The next step would be to figure the value (balance) of the loan after the three years or 36 payments.

This work is going to be done in the TVM menu. It is important that the payments are set to 12 per year:

OTHER (from the TVM menu)
12
P/YR
EXIT

And, the TVM menu must be cleared before inserting numbers:

SK (shift key)
CLR DATA

Solve for the loan payment:

175000
PV
15
SK
N
5.5
I%YR
PMT Answer: -1,429.90

Calculate the balance after three years:

3
SK
N
FV   Answer: -150,488.10

The client hasn't paid quite enough on the loan to drop the private mortgage insurance.

8. For the client looking to drop the private mortgage insurance in problem #7, will the next payment do it?

Solution: Keep the information in your calculator from problem #7 and let's see if the 37th payment will make it:

37
N
FV   Answer: -149,747.94

With the 37th payment the loan balance is below $150,000. and the client will be able to discontinue the insurance.

9. An investor is buying loans in the secondary mortgage market and has the opportunity to purchase a loan that was just made for $50,000. at 11% for a term of eight years, with semi-annual payments that fully amortize the loan. No payments have been made on the loan How much should the investor pay for this loan in order to realize a 20% annual return?

Solution: The first thing to do is to calculate the income stream - the loan payment - the investor is purchasing. From the TVM menu put in the two payments per year on this loan:

OTHER
2
P/YR
EXIT

Always a good idea to clear once back in the menu where you are performing calculations:

SK (shift key)
CLR DATA

Insert the loan information from the lender's point of view and solve for the payment:

50000
+/-
PV
11
I%YR
8
SK
N
PMT Answer: 4,779.13

Now, tell the calculator this investor wants the monthly income stream of $4,779.13 to be a 20% annual return:

20
I%YR

And ask what the loan is worth at this 20% return requirement:

PV   Answer: -37,390.50

The investor should pay (that is what the negative sign means in the answer) $37,390.50 to buy this loan and get the 20% annual return.

10. An auditor studying the records of a local lender is looking to determine what overall return the lender is making on a $2,000,000. loan made for 15 years at an annual interest rate of 8.50%. The payments are made annually and will fully amortize the loan at the end of the 15-year loan period.

Solution: What this auditor wants is the lender's return "on" and return "of."
The return "on" the lender's investment, the $2,000,000. loan, is the interest the lender is earning, the 8.50%. The return "of" is the recapture of the capital, the $2,000,000., the lender invested in a borrower.

We know the return "on,' the 8.50%. In order to calculate the return "of" we need to calculate in the TVM menu the rate per dollar the lender will recapture every year. This is annual amortization, so let's make sure the calculator is set to one payment per year. From the TVM menu:

OTHER
1
P/YR
EXIT

Is your calculator cleared, so that old numbers don't interfere with this operation? If not sure, go ahead and press in:

> SK (shift key)
> CLR DATA

Set your display to four places to the right of the decimal point:

> DSP
> FIX
> 4
> INPUT

Then, calculate the recapture rate per dollar of the loan the lender made:

> 1
> FV
> 8.5
> I%YR
> 15
> N
> PMT   Answer: .0354

This is the rate at which the lender must recapture the loan in order to get the $2,000,000. back, in addition to the interest earned, by the end of the 15-year loan term. The overall rate of return for the lender, called the "debt capitalization rate," R(d), is:

$$R(d) = \text{Return "on"} + \text{Return "of"}$$

$$= .0850 + .0354$$

$$= .1204 = 12.04\%$$

11. A real estate appraiser studying the marketplace for investor rates of return looks at the financing described in problem #11. The appraiser believes this financing is representative of the market and decides to use it in deriving a capitalization rate by the band-of-investment technique. This method uses the following formula:

$$R(o) = [LTVR \times R(d)] + [ETVR \times R(e)]$$

> R(o) = overall capitalization rate that will be applied to the subject property's net operating income in order to value the subject

> LTVR = the loan-to-value ratio, the percentage of the property value that the lender is willing to make as a loan

> R(d) = the capitalization rate for the debt, which means it is the rate of return the lender wants on the money it is loaning

ETVR = the equity-to-value ratio, the remaining percentage
of the purchase price not covered by the mortgage
loan that the investor must put into the property as
equity or down payment to complete the purchase.

R(e) = the capitalization rate for the equity, the rate of
return the investor wants on the invested equity in
money earned by the property.

Financing of this kind, the appraiser learns, is usually made at a 70%
loan-to-value ratio. In the appraiser's opinion, investors in the kind of market the
appraiser is studying, demand a return on equity of approximately 16%.

The overall capitalization rate is then:

R(o) = (.70 x .1204) + (.30 x .16)

= .0843 + .0480

= .1323 = 13.23%

Alg keystrokes

.7
x
.1204
+
(
.3
x
.16
)
=   Answer: .1323

RPN keystrokes

.7
ENTER
.1204
x
.3
ENTER
.16
x
+   Answer: .1323

12. The real estate appraiser in problem #11 elects to use that capitalization rate
to value a subject property estimated to generate a net operating income the
next year of $325,000.

This appraiser plans to use direct capitalization of the net income in order to
render an opinion of the value of the subject property. The formula for this
capitalization is:

$$V = I \div R$$

V = value
I = net operating income
R = capitalization rate

= $325,000. ÷ .1323

= $2,456,538.

<u>Alg keystrokes</u>

325000
÷
.1323
=   Answer: 2,456,538.

<u>RPN keystrokes</u>

325000
ENTER
.1323
÷   Answer: 2,456,538.

13. An income-producing property, such as the one valued in problem #12, may also
be valued using discounted cash flow analysis. The appraiser who valued the
property in the preceding problem makes the decision to value that subject
again, but this time using discounted cash flow analysis, also called "yield
capitalization." The cash flows the appraiser projects for this subject property
are:

Estimated cash flow at the end of period # 1: $325,000.
period # 2: $345,000.
periods #3 through #5: $375,000. per year
period #6: ($50,000.)
period #7: $3,000,000, including reversion
of $2,750,000.

The reversion referred to in cash flow #7 is the estimated amount for which the
property will sell at the end of this projected time. The income received for this
period is projected as the other $250,000.

After thoroughly researching the market the appraiser believes a 14% discount
rate is appropriate to value the subject expected to generate these cash flows.
The keystrokes for this valuation are performed in the cash flow menu.
Therefore, from the main menu key in:

FIN
CFLO

Clear the menu with:

> SK (shift key)
> CLR DATA
> YES

Then, press in these keystrokes to project the cash flows:

> 0
> INPUT
> 325000
> INPUT
> INPUT
> 345000
> INPUT
> INPUT
> 375000
> INPUT
> 3
> INPUT
> 50000
> +/-
> INPUT
> INPUT
> 3000000
> INPUT

After inserting the cash flows we need to go to the calculation menu:

> EXIT
> CALC

To value the property, put in the discount rate and ask for value:

> 14
> I%
> NPV Answer: 2,396,594.

Using discounted cash flow analysis as a valuation tool, the appraiser comes to a value for the subject property of $2,396,594.

14. In problem #13, the real estate appraiser used the same discount rate for the cash flows, which are probably net operating incomes, and the reversion. A realistic valuation situation might dictate, however, that different discount rates be used for these two projections.

    The uncertainty associated with predicting a reversion - what a property will sell for years ahead - could convince the professional analyst, such as a real estate agent or real estate appraiser - to use a higher discount rate for the reversion than for the cash flow incomes.

    Let's say an investor, broker, appraiser, or some other analyst was reviewing the appraisal in problem #13 and decides to revalue, using a 17% discount rate for the reversion and keeping the cash flow discount rate at 14%. What would

be the value of the subject property under this changed condition?

<u>Keystrokes</u>

0
INPUT
325000
INPUT
INPUT
345000
INPUT
INPUT
375000
INPUT
3
INPUT
50000
+/-
INPUT
INPUT
250000
INPUT

Discount this income stream with the 14% rate:

EXIT
CALC
14
I%
NPV   Answer: 1,297,592.

The present value of the incomes is $1,297,592.

Now, let's discount the reversion. We could use the discounted cash flow menu,
but it is easier to go to the TVM menu. From the calculation menu:

EXIT
EXIT
TVM

Clear the TVM menu:

SK
CLR DATA

A single sum, such as a reversion, would usually be discounted annually. So, set
your calculator to one payment per year:

OTHER
1
P/YR
EXIT

Discount the $2,750,000. reversion over seven years:

$$\begin{array}{ll} 2750000 & \\ \text{FV} & \\ 17 & \\ \text{I\%YR} & \\ 7 & \\ \text{N} & \\ \text{PV} & \text{Answer: -916,287.} \end{array}$$

This answer is shown as negative to indicate a purchaser would have to pay $916,287. for the reversion.

The value of the property is the sum of the present values of the incomes and the reversion:

$$V = PV(I) + PV(R)$$

$$= \$1,297,592. + \$916,287.$$

$$= \$2,213,879.$$

This valuation is less than that in problem #13 because the reversion in this problem was discounted more highly than the cash flows and the reversion were discounted in problem #13.

Although they vary somewhat, the valuations of the property described in problems #12, #13, and #14 are relatively close, given the magnitude of the property value. The variations are attributable to three different methods being used to value the subject property. Direct capitalization by division was used in problem #12, while discounted cash flow analysis was used in problems #13 and #14. And these latter two varied in the choice of discount rates for the reversion.

15. An analyst evaluating the three different appraisals described in problems #12, #13, and #14, concludes that a realistic value for the subject might be $2,375,000. If this is considered the value of the property, what would be the net present value and internal rate of return for an investor who wants the property enough to pay $2,500,000. for it?

The projected cash flows for the property are:

Estimated cash flow at the end of period # 1: $325,000.
period # 2: $345,000.
periods #3 through #5: $375,000. per year
period #6: ($50,000.)
period #7: $3,000,000, including reversion
of $2,750,000.

The net present value for this property would be:

$2,375,000.   present value
-2,500,000. purchase price
- 125,000. net present value

The negative net present value means the investor has overpaid for the property
by $125,000., given the value of $2,375,000.

To calculate the internal rate of return go to the cash flow menu from the main
 menu:

> FIN
> CFLO

Clear the menu:

> SK
> CLR DATA
> YES

Put in the purchase price and the cash flows:

> 2500000
> +/-
> INPUT
> 325000
> INPUT
> INPUT
> 345000
> INPUT
> INPUT
> 375000
> INPUT
> 3
> INPUT
> 50000
> +/-
> INPUT
> INPUT
> 3000000
> INPUT

Go to the calculation menu:

> EXIT
> CALC

Ask the calculator for the internal rate of return:

> IRR%   Answer: 13.02

This investor may be paying more than what one analyst feels the property is
worth. Yet, the property is still generating an internal rate of return on the
$2,500,000. purchase price of 13.02%.