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When you calculate a loan payment you are determining what periodic payment a borrower must make to pay all or part of a loan back to the lender. But how about during the life of the loan? What is happening to that loan as it is being paid back? Unless the payments are for interest only, the borrower is slowly but surely reducing the indebtedness owed to the lender.

Of course, not all of the payment, in almost all cases, is being applied to pay down the principal, that is, the amount owed the lender. Some of the money - often a lot of the loan payment! - is applied to interest, the cost of borrowing the money. What we are going to do in this section is calculate these figures, how much is going to interest, to principal, and what the loan balance is at any one time.

HOW INTEREST IS COMPUTED:

First, let's figure out a loan payment. Say we have a \$150,000. loan at 9% annual interest over a loan term of 30 years payable on a monthly basis. What that means is that 9% of the loan balance will be charged annually for the interest. Actually, for a loan that is paid more frequently than annually, the interest is going to turn out to be less than 9% of the starting loan amount. The reason for that is that interest is charged on the loan balance and as that balance declines, that is, as portions of the loan payments are applied to reducing the principal amount owed, the 9% is applied to the reduced loan amount still outstanding.

Look at the interest that will be due on this loan for the first of the 360 payments (12 months a year times 30 years):

$$\begin{array}{r} \$150,000. \\ \times \quad .09 \\ \hline \$ 13,500. \end{array}$$

Divide 12 months per year into the annualized interest of \$13,500. to get \$1,125.

Keystrokes

Algebraic:

$$\begin{array}{r} 150000 \\ \times \\ 9 \\ \% \\ \div \\ 12 \\ = \end{array} \quad \text{Answer: } 1,125.00$$

RPN:

$$\begin{array}{r} 150000 \\ \text{ENTER} \\ 9 \\ \% \\ 12 \\ \div \end{array} \quad \text{Answer: } 1,125.00$$

So, for the first month \$1,125. of the loan payment will be applied to interest and the remainder of the loan payment, which we figure below, will go to paying down the principal. The interest for the second month is then calculated on the loan balance having been reduced by the portion applied to principal from the first month's payment. This balance will be multiplied by 9%, the result will be divided by 12 months to figure out the second month's interest and the remainder of the loan payment applied to the principal loan balance.

AS TIME GOES BY:

A little bit less is applied to interest for the second month compared to that applied to interest for the first month because the 9% interest is taken of a loan balance in the second month that is slightly less than the starting amount of the loan that was used to calculate the first month's interest. Hence, slightly more is applied to principal for the second month from that constant loan payment. In this way, over the life of a loan, less and less is applied to interest and more and more is applied to principal the longer the loan is held.

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Let's look at this loan. Say the payments made on a monthly basis are going to fully amortize the loan, meaning they will entirely pay off the loan by the end of the loan term, the 30 years. You can have a partially amortized loan in which the payments pay off part of the principal, but by the end of the loan period there is still part of the loan outstanding that hasn't been paid off, what is called a "balloon payment." And, of course, you can have an interest-only loan in which the entire periodic payment is applied to interest and the full amount of the loan is owed at the end of the loan term.

CHECKLIST:

Check to make sure your calculator is set to 12 payments per year, for the monthly amortization. From the main menu press 'FIN' and then 'TVM' in the next menu. This menu will state how many payments per year the calculator is set. See it? Yes, it is to the far left of the display. If it doesn't say "12 P/YR," go to the far right of the TVM menu where you should see "OTHER." Press that and in the resulting menu you have "P/YR" to the far left. Press '12' and then 'P/YR.'

Before leaving this menu also check the right of the display to where it identifies the mode, either "BEGIN" or "END." Unless you are working a problem in which interest is being paid in advance (at the beginning of the period), you want to be in the End mode. You can go between these two modes by pressing their buttons in this menu. We will do our problems in the End mode, so press 'END' if your display reads "BEGIN MODE."

Now, back to the TVM menu. Press 'EXIT.'

THE LOAN PAYMENT:

Set your display for two places to the right of the decimal:

```
DSP
FIX
2
INPUT
```

It will make a slight difference in interest, principal, and loan balance figures calculated if another decimal setting is used.

Calculate the loan payment for this loan with these keystrokes:

```
150000
PV
9
I%YR
30
SK
N
PMT    Answer: -1,206.93
```

We put the loan amount in the present value register as a positive number. That signifies that we are doing this from the viewpoint of the borrower because the borrower is getting the money, the positive \$150,000. "flowing" to the borrower. The negative sign on the loan payment means the borrower has to pay out (money flowing away from the borrower) the loan payment to the lender.

If we were doing this from the lender's point of view, we would insert the loan amount as a negative number, using the '+/-' key after keying in the loan amount and before pressing 'PV.' The loan payment would then come out as a positive number, showing that the loan payment is "flowing" to the lender. Please see our section on time-value-of-money for more on calculating loan payments.

AMORTIZING THE LOAN:

Now, let's look at what's going on with this loan as the payments are being made. That is, we'll take a look at how much interest and principal have been paid at a particular time of the loan term, and what the remaining principal balance is after so many payments have been made.

Let's say we want to determine, after this loan has been paid on for seven years, the total amount of interest paid during the seven years, also the total amount applied to principal, and the balance still owed on the loan after this seven-year period.

Setting the Number of Payments

In the TVM menu where you calculated the loan payment go to the far right and press 'OTHER.' In the resulting menu (where you were when you set payments per year) go to the far right again and press 'AMRT.' In this amortization menu you should see the instructions for amortizing our loan.

"KEY #PMTS" means the calculator wants us to tell it over how many payments we want to amortize. We must tell it in the language we used to calculate the loan payment. That is, we can't tell it seven years because the 'N' register was given the total number of payments (months) as 360. So, we must speak in the language of months when we ask the calculator to amortize.

Therefore, key in '84' (seven years times 12 payments per year) and press '#P.' The display will tell you the range of payments over which you have amortized this loan, in this case, "PMTS: 1-84."

Getting Interest, Principal, and Loan Balance

Then, press 'INT,' 'PRIN,' and 'BAL' to see the total amounts applied to interest and principal over these 84 months and the current balance of the loan.

The Keystrokes (after getting the loan payment)

OTHER	
AMRT	
84	
#P	
INT	Answer: -91,843.23
PRIN	Answer: -9,538.89

The minus signs on the interest and principal figures indicate the borrower paid these monies to the lender.

BAL	Answer: 140,461.11
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AMORTIZE THE LOAN SOME MORE:

In this amortization menu there is to the right a key for "NEXT." Pressing that key will give you the interest, principal, and balance figures for the next number of payments that you just amortized. Since we just amortized the first 84 payments, the next group of equal number of payments would be the 85th through the 168th payments, which will show in the display if you press 'NEXT.' Then pressing the interest, principal, and balance keys will give you those figures for this next range of payments.

The Keystrokes

NEXT	
INT	Answer: -83,513.84
PRIN	Answer: -17,868.28
BAL	Answer: 122,592.83

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Note that these amortization figures are just for payments 85 through 168 and do not include the interest and principal paid during the first 84 payments. Of course, the balance figure of \$122,592.83 is what is still owed on the loan after the borrower has paid 168 payments.

You can amortize over any range of payments. So, after the first 84 payments, instead of amortizing the next 84 by pressing 'NEXT,' we could have just amortized the next year of payments by pressing '12,' the next 2 years by pressing '24,' whatever range of payments you want.